PB-230 149

NATIONAL ESTUARINE POLLUTION STUDY. PROCEEDINGS OF THE WASHINGTON PUBLIC MEETINGS HELD AT ABERDEEN, WASHINGTON, ON 25 JULY, 1968, AND SEATTLE, WASHINGTON ON JULY 23, 1968

Federal Water Pollution Control Administration
Portland, Oregon

1968

DISTRIBUTED BY:

NTIS
National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

PB 230 149

PROCEEDINGS

of the

WASHINGTON PUBLIC MEETINGS

NATIONAL ESTUARINE POLLUTION STUDY

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION

July 23, 1968
Pacific Science Center
Seattle, Washington

July 25, 1968
Morck Hotel
Aberdeen, Washington

United States Department of the Interior
Federal Water Pollution Control Administration
Northwest Region, 501 Pittock Block, Portland, Oregon 97205

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

LIBRARY
Dept. of the Interior FWPCA
Edison, N. J. 08817

FOREWORD

The public meeting transcript which follows is an important part of the National Estuarine Pollution Study. In the Clean Waters Restoration Act of 1966, Congress directed the Secretary of the Interior to conduct a study of the Nation's estuaries and to submit a report by November, 1969. The report is to include recommendations for a comprehensive national program for the preservation, use and development of the estuaries, and the respective responsibilities which should be assumed by Federal, State, and local governments, and by public and private interests. Jointly sponsored by the State of Washington and the Northwest Regional Office, Federal Water Pollution Control Administration, the meeting provided an opportunity for all interested individuals and organizations to express their views on management and development of Washington's coastal zones.

CONTENTS

PART I - ORAL STATEMENTS PRESENTED AT PACIFIC SCIENCE CENTER, EAMES THEATER, SEATTLE, WASHINGTON, JULY 23, 1968.

PAGE

Call to Order by Mr. Herbert C. Clare 3

Opening Remarks and Introduction of Panel 3

Speakers;

Mr. John J. O'Connell, Attorney General, State of Washington 9

Mr. Marvin Durning 16

Mr. C.S. Zickefoose 23

Discussion. 25

Mr. Francis G. Bartlett, University of Washington 27

Discussion 30

Mrs. Denton Sherry, Representative, Save Port Susan Committee. 31

Mr. Arthur H. Yoshioka, Representative, Port of Seattle 35

Discussion 41

Mr. Wayne Bishop, Seattle City Light Department 42

Mr. Bob O. Bower, Washington State Director, Oyster Institute of North America 44

Discussion 49

Dr. Max Katz, Representative, Washington State Sportsmen's Council 51

Discussion 61

Mr. John E. Ward, Representative, Public Utility District No. #1 of Snohomish County. 62

Discussion 66

(Continued)

PART I (Cont'd)

PAGE

Mr. Harry R. Fulton, Director of Planning, Whatcom County Regional Planning Council. . . 69

Discussion. 74

Mr. Conrad Hougen, President, Washington Ass'n of Conservation Districts. 75

Mr. C.S. Sargent, Representative, Natural Resource Committee, Association of Washington Industries 79

Closing Announcements. 83

Adjournment 84

PART II - Written Statements

PAGE

Thomas Pelly, Congressional Representative, 1st District, House Office Bldg., Washington, D.C. 20515. 87

Western Washington State College, Department of Biology, Bellingham, Washington 91

Kent Mountford, Department of Botany, Rutgers University, New Brunswick, N.J. 08903 93

Port of Seattle, P.O. Box 1209, Seattle, Washington. 98111. 97

Mrs. Denton Sherry, Save Port Susan Committee, 17221 Palatine No. Seattle, Washington. 98133. 104

Washington State Association of County Park Boards and Departments 110

Skagit County Park Recreation Board 111

Whatcom County Soil and Water Conservation District 113

Professor Francis G. Bartlett, General Engineering Department, University of Washington 114

APPENDICES PAGE

A. List of Speakers at Seattle, Washington 117

B. List of Attendees, Seattle, Washington 118

INDEX 419

SEATTLE MEETING

PART I

ORAL STATEMENTS
PRESENTED AT SEATTLE,
WASHINGTON, JULY 23, 1968.

PROCEEDINGS

MR. CLARE: We are a few minutes late, ladies and gentlemen, and we'd like to start this meeting.

This is the first of two meetings which are being held on the coastal waters of the State of Washington to consider the impact of pollution on Washington's coastal waters. The second session will be held in Aberdeen beginning at 9:30 on Thursday morning, July 25. As you know from the announcement which you received of this meeting, they are being conducted as part of the joint Federal-State input to the National Estuarine Pollution Study.

My name is Herbert C. Clare. I am representing Mr. R. F. Poston, Regional Director of the Northwest Region, Federal Water Pollution Control Administration, Department of the Interior.

First I would like to make a few introductory announcements -- after which I will introduce our co-chairman and the panel members. The first is that we are anxious to have each of you register, indicating whether you would like to have a copy of the proceedings or whether you'd like to make a statement at this meeting. You will note that a report of this proceedings is being made by Mr. Allan Johnson of the Cascade Reporting Service. A transcript of the proceedings will be combined with that of the Aberdeen meeting, which is to be held on Thursday, and a copy will be made available to you on request.

If any of you decides later in the meeting that you would like to make a statement, please contact the young lady at the registration desk and she will notify the co-chairman.

Also, I have been asked by the Inland Empire Waterways Association to announce that most members of that Association cannot be present at this meeting in Seattle because of a conflict with a meeting of the Northwest Rivers and Harbors Congress which is being held in Olympia today. Representatives of ports and others who are attending that meeting will have an opportunity to participate in our second meeting which will be held in Aberdeen on Thursday, July 25. We look forward to hearing from them at that time.

Please understand that this is your meeting. State and Federal agencies are being consulted separately and have not been asked to be heard from today. This meeting is the opportunity for you and your organization to make your views clearly known regarding present and potential problems in maintaining the quality of Washington's coastal waters as related to land and water uses.

Now I should like to introduce the panel which is before you today. This panel is not here to judge or to cross-examine those of you who make statements. They want to hear from you and to understand what you have to say. Occasionally, members of the panel will ask questions of a speaker to clarify a point or to guide discussions to bring out and to clarify views on an important aspect of the subject presented.

First is Mr. James P. Behlke, Director of the Washington Water Pollution Control Commission and Co-chairman of this meeting. Governor Evans has appointed Mr. Behlke as Coordinator for the State of Washington's input to the National Estuarine Pollution Study.

Mr. T. A. Wastler from FWPCA's office of Estuarine Studies at our Headquarters in Washington, D.C. Mr. Wastler's program is responsible for the overall conduct of the National Estuarine Pollution Study.

Mr. Lloyd Kirry, Assistant Director of the State of Washington's Planning and Community Affairs Agency.

Mr. John Vlastelicia from our Northwest Regional Office staff in Portland, Oregon. John is our Regional Coordinator for the National Estuarine Pollution Study.

We are very glad for this good attendance at this meeting as this is an indication of your recognition of its importance and we are looking forward to your contribution to the record on this important matter. All of us here, I am sure, can agree that our estuaries are important and valuable national resources ecologically, economically, socially, and aesthetically, and that the nation has a vital interest in their beneficial uses and their protection or restoration.

Congress recognized the need to protect our estuaries, and in the Clean Waters Restoration Act of 1966, an Amendment to the Federal Water Pollution Control Act, it directed the Secretary of the Interior, in cooperation with the many public and private interests concerned, to submit a report to Congress by November 1969. Congress directed that this report should include "recommendations for a comprehensive national program for the preservation, study, use, and development of the estuaries of the nation and the respective responsibilities that should be assumed by Federal, State, local governments, and by public or private interests".

The responsibility for coordinating the study and preparing the response to Congress was assigned to our Agency, the Federal Water Pollution Control Administration. Our approach has been along three lines. First, the estuaries themselves are examined. A description of the national system will be composited in terms of what it is, how it functions, and how it has been damaged by pollution. Next, the social and economic pressures on the estuarine system are being studied. Resource use and the associated economic and social values will be documented to establish the relative importance of these factors to the estuarine system.

These first two phases will provide an estuarine register--a comprehensive inventory--a necessary base for a management plan.

Finally, then on the basis of these studies, recommendations will be prepared for submission to Congress. The recommendations will incorporate the important environmental, social, economic, and political factors, and will be, in essence, a recommended management plan, describing the estuaries and proposing a management system of authorities and responsibilities for their use and wise development.

This ambitious task, of course, cannot be done in any one Federal office. Its success requires that we seek help and advice and the counsel of others. Each Federal agency involved in estuarine work is providing us with program descriptions and comments. Likewise, we are working closely with each coastal State. In this case, we are working with the State of Washington. Through Mr. Behlke's coordination we will obtain a consolidated description of Washington's programs and views related to estuary management and development. A very important part of their effort is co-sponsorship of today's meeting to hear what your views are in this regard.

Today's meeting is an opportunity that should not go unheeded. Congress has asked for recommendations before it legislates and it is important that your views be considered.

Now I should like to ask Mr. Behlke to state the implications of this work as it pertains to the interests of the State of Washington.

Mr. Behlke.

MR. BEHLKE: The Attorney General, Mr. O'Connell, is on the panel.

The State of Washington is highly interested in the resource in the value of our estuaries. This is personified by the number of agencies in State Government, such as Fisheries, Game, Parks, Hunting, and Water Pollution Control that work on a day to day basis with estuaries and estuary control. We are certainly happy to see such a large group here from the general public that are interested in the same area of estuarine management and control and preservation.

I believe the statement out of the pamphlet is a discussion of the major economic and ecological trends as they have been influencing future pollution problems and the thorough concern for wildlife and the aesthetics of our estuaries.

I would again thank you for coming today.

MR. CLARE: Thank you, Mr. Behlke.

Mr. Behlke has already recognized the presence of Mr. John J. O'Connell, Attorney General of the State of Washington, and to Mr. O'Connell, we would like to hear from you at this time if you would, please.

JOHN J. O'CONNELL

MR. O'CONNELL: Mr. Chairman, Mr. Behlke, and members of the panel. My name is John O'Connell, as indicated, and I'm currently the Attorney General of our State. I want to express my appreciation for the kindness of this panel in allowing me to be here and to present some of my views.

Over a number of years I have expressed my concern over the deterioration of our State's natural environment, having been born here and raised here, a very real threat to Washington's livability caused by our careless pollution of our surroundings. One of the great challenges to the citizens of our State and its government is to conquer the ever-increasing threat to our greatest and most precious natural resource, water. As Attorney General of the State for a number of years, almost 12, I have had the opportunity to view government, and especially State Government, its attempt to tackle the problem of controlling water pollution. It's an unhappy commentary that the record of combatting water pollution in this State over the past decade has left much to be desired. There have been bright spots from time to time, but unfortunately these highlights have been too few in number. At best the water pollution control program of our State can be characterized as spotty, too many false starts, too many high sounding promises and not enough action and I want to make it clear that I don't point a personal finger, for one I believe our State government with full cooperation from both federal and local levels can carry out the kind of effective program of water quality control the public demands and the public interest requires.

Before mentioning the pollution problems of our estuary waters, I wish to note briefly some general comments on the type of water pollution control program which I believe we should have in our State. The waters in the State of Washington must be maintained at the highest possible quality reasonably obtainable. In this regard there are two cardinal principles which must be included in any sound water pollution program for our State. First, the waters that are now polluted must be immediately improved to an acceptable quality, and second, our high quality waters must not be allowed to be degraded in the future. A program developed on the bedrock of these two principles, coupled with an energetic dedicated staff of water control administrators, engineers, scientists and other experts, can in my opinion provide a sound basis for optimism that the battle to protect our waters can be won in our State. The great challenge to State officials responsible for protecting the public's waters is to see that these principles are not compromised; the failure to withstand the continual and increasing pressure of various interests to use our public waters as sewers would be to court a disaster which would not only be uncalled for, but would be intolerable.

Are the estuaries and coastal areas of Washington, of which there are many, worth protecting? I am neither a biologist nor a sanitary engineer and I rely on conclusions reached by members of those particular professions and in my review it has become clear that the value of the resources along the margins of the oceans is immense, in Washington the value of this is especially significant, not only do estuaries and coastal waters provide valuable areas for spawning and development of both fin and shellfish, but they furnish resting places and food sources for limitless numbers of migrating birds as well as breeding and rearing areas for countless others. In addition these areas provide many types of recreational opportunities, hunting, fishing, hiking and bird watching to just plain watching. Because of man's activities, substantial portions of our estuary environment, especially in Puget Sound, have been destroyed or significantly modified and this progress, or rather process, continues right today. The filling of estuary areas with industrial areas and subdivisions is not an uncommon practice and dredging for navigational improvements and for gravel and sand is commonplace. In addition, great amounts of municipal and industrial waste as discharged into the estuary area. For example the agencies that are represented here reported last year that each day eight pulp mills discharged waste into Puget Sound and the Straits in amounts equal to the discharges of a city twice the size of the city of Los Angeles. The same report concludes that these discharges cause substantial damage to the marine environment.

Accepting the proposition as I do that the State of Washington's estuarial areas are of significance and worth saving, and recognizing that neither the state nor federal government has provided for their protection, a sound program of management for estuarial waters and related land uses now must be developed. This leads me to the question how shall an estuarial program protect and more protection be carried out and by whom. I believe firmly that State government can, with proper leadership, play a significant role in our federal system and while recognizing that there is a federal interest involved, I support the concept that primary management responsibility over estuaries should rest in State government. By this I support the general approach of federal and State cooperation which is embodied in the Federal Water Pollution Control Act, and that is that State government should be provided the opportunity to establish and exercise management and protection program over the estuarial areas within the State boundaries. Only if it appears that the State is failing to meet its responsibilities should a direct management role be activated by the federal government.

How can this protection be accomplished at the State level? Certainly immediate steps of significance can be taken. The one that first comes to mind is to vigorously and uncompromisingly enforce the water quality standards for interstate waters adopted in December of last year by the State Water Pollution Control Commission and recently approved by the Secretary of Interior. These standards contain a non-degradation clause which provides in effect that waters of the State will not be reduced in quality from the quality existing at the time of the adoption of the standards. Strict compliance with this clause will halt or reduce substantially any further injury to estuarine areas, at least until a comprehensive management program can be developed. In addition, State government can review with a much more critical eye applications for dredging permits for estuarine areas when referred to the State by the Army Corps of Engineers and in areas where critical environmental problems exist a moratorium on further activities should be declared until a long range management program can be developed.

The most important recommendation I propose deals with the establishment in the State of an Estuary Protection Act by the next session of our State Legislature. This Act would authorize the State to zone uses in estuaries and adjacent lands and acquire estuary areas of special significance. The Act would provide State government with a valuable tool for carrying out its proper role in the federal system.

Returning briefly to Uncle Sam, I envision its position as a two-phased supporting role, one role it can provide leadership on the national level through a mass program to educate the public of the need of preservation of the estuaries, it can also provide general guidelines to assist the states in developing uniform programs throughout our union, and in a more complete role, the federal government can provide monies to assist states carrying out operational education and training programs and in addition the government can conduct research to provide better understanding of the problems faced in the estuary management.

Earlier I discussed in rather critical terms the State of Washington's past performance in implementing a satisfactory water pollution control program. This doesn't mean that I'm necessarily pessimistic about the future. The 1967 session of our State Legislature, notably through the efforts of State Senator Wilbur Hallar, enacted legislation strengthening our water pollution control law and also the Clean Waters Act of 1965 and '66 and these are both signs pointing to a brighter future; if the leadership is provided at the very highest level of State and federal government this brighter future can be realized and I think we can do no less.

These are my views and I wish every success to the study. I think it's of vast importance, particularly to the State of Washington, and I trust the end result will be a resolution of our problems in the area of water, a higher quality of water for our people and the uses of our people in this State.

I thank you, Mr. Chairman.

MR. CLARE: Thank you, Mr. O'Connell. I wonder if you'd be willing to answer some questions in case the panel have them.

MR. O'CONNELL: Yes.

MR. CLARE: We do appreciate this comprehensive and helpful statement from Attorney General O'Connell.

Does any member of the panel have a question?

(No response)

Thank you again.

I wonder if we might hear next from Marvin Durning, who is recognized as a leading spokesman for conservation, and I would like to ask that each of the speakers who has a copy of his statement if he would leave it with Mr. Johnson, it would be helpful in preparing these proceedings for the meeting.

Mr. Durning?

MARVIN DURNING

MR. DURNING: Thank you very much, and thank you for permitting me to follow our distinguished Attorney General, Mr. John O'Connell, it's a path I hope to continue to follow.

I'm going to address you this morning in somewhat unusual terms, as I look around the room, because I think it's an unusual topic in an unusual year. Fellow revolutionaries, for that's what you are if you are Americans in 1968. We live in a revolutionary America, it's growing and changing at a fantastic pace. We've added 50 million people since the outbreak of the Korean War and two million people off the land in the last 15 years, we've reached a gross national product of 800 billion dollars and we add each year as much as all but seven other nations of the world put together would produce. We're building things on the land of America at such a rate that we shall rebuild America in the next 40 years. We've turned the American Columbia River, the great river of the west, in one generation from a roaring tyrant to a series of slack pools behind power dams unparallelled anywhere on earth, we have raised the temperature of the great river of the west itself as it cools the world's largest concentration of nuclear reactors at Hanford, Washington.

Fellow revolutionaries, we are changing, each of us is individually changing and growing older, but as a nation we are growing younger and we are growing younger rapidly and that is important for our attitudes will change too. By the early 1970's we will be the youngest nation in the whole free world, the richest, most productive and the most ecologically advanced and one of the best educated in the world. Now I suggest, fellow revolutionaries, that if you are faced with a revolution in population and urbanization of production and incomes and technology in people, you are truly faced with a revolutionary America, then if you are a dreamer and a maker of bold plans and visionary you are a practical man, and if you're a little thinker and a believer that you can go on doing everything you did in the past, you are a dreamer and Americans are a practical people and they must turn their practical people's attention to new dreams about the shore lands and the coastal waters of the United States and the Pacific Northwest. This Northwest is one of the fastest growing areas of revolutionary America. In this Northwest the new attitudes can be more likely become more easily achieved than perhaps anywhere in America. You have heard and are familiar with the regulations and the programsfor the water and we could add on that that there are new federal and State programs in air pollution control. Like Mr. O'Connell I would like to concentrate my attention on the gap and that is the shorelines and the regulations of the uses of land along the coastal waters and the rivers and the harbors and the bay.

The land use regulation of the shorelines of the estuaries and coastal waters is absolutely necessary. Without it none of the rest will be of an avail. Water pollution control is based upon controlling activities on land to a large extent which discharge into water. Air pollution control is in a large extent a regulation of uses on land which discharge into the air. Each of us in this revolutionary America has his dreams. Yesterday morning I was at the Rivers and Harbors Conference which was mentioned. Let's put it this way, I don't think all of their dreams and my dreams about the rivers and harbors of the states of the Northwest are the same, perhaps their dreams and some of my dreams are in collison of course and, gentlemen, consider that the Bonneville Power Administration says we will need one million kilowatts of additional power per year starting in the early 1970's and that most of that will be nuclear power and that everybody says nuclear plants will be located on water and where, and on which rivers, which estuaries or which coast spots? The Port of Tacoma tells us we need a cheap water port for new types of ocean going ships, but so does the Port of Everett and the Port of Seattle and the Port of Bellingham and the Port of Vancouver, and everywhere else. How many of these deep water ports do we need and where? A member of the Forward Thrust Committee who is a vice president of one of the leading banks, an officer of the Seattle Area Industrial Council, discussed with us the needs of industry for flat land alongside water and flatly stated that new industrial opportunities in the next several decades could absolutely line the shores of Puget Sound and much of the ocean shores with new types of plants, that they all wanted to come along the water on flat land. Airports, the Port of Portland in the National Airport says we need larger airports and that they would like to extend a jet runway into the Columbia River and fill a substantial proportion taking islands, one of which is a wildlife refuge. The Port of Seattle says we need a new type of airport and one of the discussions is the extension of runways into water. The recreation homesites, last Saturday the Seattle Post Intelligencer had a ten page special supplement, all of it advertisements of the sale of waterfront land for recreation homesites, ten solid pages of coastal water shorelands in the estuaries for sale for private use in the State of Washington.

Recreation. Water is the focal point of outdoor recreation and demands for outdoor recreation are rising at a dizzying pace. Whether it's deficient to swim in, to boat on or walk by or just to look at, waterfront is the focal point in the demand for outdoor recreation. All of those demands, industry, power, deep ports, airports, recreation homesites, outdoor recreation, they're all focused on the limited supply of waterfronts of the coastal waters and estuaries of the State. We're on a collision course. Port Susan Bay, Guemes Island, the Nisqually Flats, proposals to dredge the Skagit River, we're looking forward under our present system to a generation of statewide zoning fights, what we've seen is a mere beginning of the fantastic anarchy which will probably end up in the desecration of the coastal shoreline and the rivers, harbors and bays. There is only one solution for practical men, it is land use control, planning and land use control of the land uses of the shorelands of the major rivers, harbors and bays and estuaries of this State and of the rest of the Northwest, and if I could be so bold, of the whole United States. The authority is there, the instrument of government is there, the mechanisms are there, it is the use of sovereign power of State government to control these land uses, the authority is there. When the natural resources of the forests of this State were threatened, the State of Washington through its Legislature developed the policy that even private land owners on their own forest lands must reforest; that was challenged in the State Supreme Court and upheld as a necessary exercise of the sovereign power of the people to preserve one of their basic natural resources. More recently we have used that sovereign power to enforce air pollution control statutes and water pollution control statutes; each of these in its own way is a land use control statute to try to define which uses have which types of admissions and which types of places would be permitted. Even more basically in the Highway Advertising Control Act of 1961 the Legislature of the State of Washington said that within 660 feet of the right-of-way of the interstate highway system within the borders of the State of Washington it would regulate one kind of land use called billboard, and that Act has been upheld very recently by a seven to one decision of our State Supreme Court. There can no longer be any question of the sovereign power of the State is sufficient to protect, to zone and to protect against harmful land uses in areas of statewide interest; the mechanism is there, the Legislature should not act blindly. The State Planning Community Agency provides us with staff assistance for the first time to bring forth, and I would hope quickly, the kinds of information necessary for legislative zoning of shorelines. Why the State government? Why not leave it to local governments? Because the local governments of this State are inadequate to meet the challenges before them in the area of zoning. The interest of the State itself must be asserted, it should not be left to the County Commissioners on the small San Juan Islands County to determine the future of the San Juan Islands; it should not be left to the Commissioners of a small Columbia River County to determine the future of the Columbia Gorge; the interests of the State are too great and all of the people of the State of Washington. The State government should take the authority. The need is there, the mechanism is there and the legislative means to do the job. This is not our traditional American way with respect to land it will be said, that is right, our traditional American way with respect to land is to rape it and move on, it is time we ended our traditional American way of ruining the land.

I think in 1968 there is a new politics, there is a new conservation, there is a new attitude, and I endorse Mr. O'Connell's proposal of the State Estuary Act as a specific example of my recommendation for State controls.

Thank you.

MR. CLARE: Thank you, Mr. Durning.

Do any of the members of the panel have a question of Mr. Durning?

(No response)

Thank you again for a very helpful statement.

I would like next to hear from C. S. Zickefoose. I'm compelled to call him Chuck, for I have known him for a long time. Mr. Zickefoose represents today the Washington Environmental Council. Chuck, it's nice to have you with us.

C. S. ZICKEFOOSE

MR. ZICKEFOOSE: We the members of the Washington Environmental Council whose aims are to encourage citizen, legislative, and administrative action toward the protection and restoration of our natural and historic heritage, and the creation of an urban environment which reflects these values, through creative planning, education, and wise stewardship, wish to go on record at this hearing supporting the following principles applying to the impacts of pollution on coastal waters:

1. That we recognize favorably the previous work that has been done in initiating the "Clean Water Restoration Act of 1966" and for providing a forum to hear the views of organizations such as ours in an open hearing.

2. We recommend that in all instances when it is practical the concept of multiple use of the estuary be adhered to, as long as existing water quality standards

are not lowered and further that:

a. All estuaries always be maintained in such a condition that migratory fish runs can be supported on a year around basis.

b. Priorities of estuary use be established by the state or other such agencies within the state which may be legally authorized to do so.

3. We recommend that water quality monitoring programs be implemented to obtain adequate information on conditions in all estuaries. This information should be collected by automatic means where possible by agencies both private and governmental that are charged with maintaining existing water quality standards. This information would be available to state regulatory agencies for public benefit. We further recommend that local agencies be given this responsibility where legislation allows, and that state agencies obtain this information where it is not practical for others to do so.

4. We recommend that management of estuaries be at the state level or lower, definitely not solely a federal function. We further recommend that the concept of the water shed region be considered where persons from representative interests in a given water shed would establish policy and bear the responsibility of management and water quality implementation.

5. We recommend that particular consideration be given to control of pollution sources associated with pleasure craft and commercial shipping. A case in point is the problem of prevention of illegal petroleum product dumping and clean-up of spills after they occur. Clarification and strengthening of existing legislation is urged by this committee.

Respectfully submitted, C. S. Zickefoose, Chairman of the Water Pollution Control Committee, Washington Environmental Council.

MR. CLARE: Thank you very much. May we ask you some questions?

MR. BEHLKE: I listened to your statement and there was somewhat of a conflict with Mr. Durning's statement, I felt, in terms -- well, I feel we're all for preservation of the estuaries and the management you reflected more the regional or the water shed type management program; Mr. Durning pointed out the fact that small entities throughout the State weren't able to exercise sufficient control to preserve in many cases these estuaries. What is your feeling on this?

MR. ZICKEFOOSE: Our thought was somewhat similar to what is being done in air pollution control, a water shed would have to be defined by some method of government, but State or sub-State regions could be established or maybe if it did go across State boundaries something like the Delway River or SANCO, but where representatives of the people in a given estuary or basin would have the control of that particular basin.

MR. BEHLKE: This would be actually more of a control management type rather than on an operator of facilities?

MR. ZICKEFOOSE: They would set priorities, it depends on what your definition of management would be.

MR. BEHLKE: What I'm trying to get at, it would not be an operator and controller at the same time, for example METRO, it would not be an agency of this nature?

MR. ZICKEFOOSE: No, it would have to be larger.

MR. BEHLKE: Or an agency that actually operates facilities, it would be a non-operating agency or an operating agency.

MR. ZICKEFOOSE: It would be a set policy, some agencies will carry out the policies established by a water shed regional government.

MR. BEHLKE: Thank you.

MR. CLARE: Any other questions?

(No response)

Thank you again.

At this time I would like to recognize two who had registered, although they indicated they don't plan to make statements, Robert O'Brien and Congressman Hicks, we're glad to have you with us, and State Representative David Ceccarelli, and Attorney General O'Connell, I understand two of your staff are here also, Charles Roe and David Boerner, are these gentlemen here? We're glad to see you, gentlemen.

Now next we'd like to hear from Francis G. Bartlett of the University of Washington. Mr. Bartlett, if you have a copy of the paper you might give it to Mr. Johnson before your presentation, it might help him.

FRANCIS G. BARTLETT

MR. BARTLETT: Thank you for the opportunity of speaking before this body. What I have to say pertains to items I feel are going to be developed in the future and they are problems I do not believe are soluble immediately, however I do not think they should be overlooked in the consideration of the general water pollution control.

The problem of Puget Sound for some time in the future, two events, two items, that I have gathered from the Motorship Magazine, a British publication, are important. In January of 1968 this magazine indicated that there were nine tankers in service throughout the world with a carrying capacity of 150,000 tons dead weight or over; these ships have loaded drafts ranging between 52'6 and 62'. Also in the same issue of that magazine I did a little calculating to the extent that over 80 per cent of the tankers being built throughout the world or on order at that time consisted of ships having a dead weight tonnage of 175,000 tons or over, these ships have loaded drafts ranging from 53'10" to 71'. Associated with this is an appraisal of hydrographic charts on the west coast of the United States and an observation of where the ten fathom curve is and you'll notice that the ten fathom curve is outside of every port in the entire west coast with the exception of Puget Sound, the ten fathom curve comes into Puget Sound providing protective waters. Now obviously this is not a true picture of what exists today because all of our ports on the west coast do have channels dredged into them, but all of these channels are limited to the dredging capacity of the present dredges and there aren't too many skippers I believe in this world who are willing to take 150 or 200,000 tons of ship into a dredged channel with only six inches of spare draft of water, so my point is as the future unfolds Puget Sound is one of the few places in the West Coast where these large ships are going to be able to come, whether or not they come here I'm not specifying, this is a matter of economic geography to determine, but I do feel as the future unfolds it will happen as the oil industry uses up existing resources and we see new developments in Alaska and we see possibilities of having to bring oil to the west coast from the Persian Gulf. Now we do have certain guidelines on how to handle these ships that are being developed. An outstanding example is Bantry Bay in Ireland where off shore discharges are being built. There are several installations being built in Japan, Tokyo Bay in Japan. In particular I noticed recently where Delaware Bay is contemplating the same facility and I'm speaking from the point of view of bulk carriers and I've spoken with particular reference to oil carriers. Dry bulk carriers are also increasing in size rather substantially, they are over 100,000 tons now.

Another item of course that must be brought up in connection with bulk oil is the rather unhappy circumstance of the Torrey Canyon that went on the rocks off east England and contaminated ports and seashore in England, also across the channel in France. I shudder at the thought of having 100,000 tons go on the rocks someplace up here like at point no point; this is something I think we do have to think very seriously about and as the future does unfold and as these bigger ships are developed, after all there is 80 per cent of the dead weight tonnage of these ships are over 175,000 tons, this is the trend that the ship owners are taking and one of the reasons they're doing it is because it's cheaper to move bulk in large ships than it is in small ships, this is going to be something that affects us and it's rather amazing that we have so many ships on the Sound today where it appears the drafts are as limited as they are. I don't know what some of the people were thinking when they put these things in, but anyway, this is a point that I wanted to bring before this body and I don't think it can be overlooked, and I thank you very much for this opportunity.

MR. CLARE: Thank you very much, Mr. Bartlett. Any questions from the panel?

MR. VLASTELICIA: You apparently have done some vast research into the size of ships in the future for bulk carriers and this sort of thing, and recognizing that Puget Sound is one of the deeper estuaries and of the need for planning now, is there anything being done in the way of planning off shore facilities for handling bulk transfer rather than to bringing them into estuaries right now, is there any outlook for this?

MR. BARTLETT: The only instance of this is as I have indicated, Bantry Bay in Ireland, and this is in an estuary, but doing this on the off shore, if you were to consider the escalation of some off shore facilities like off Cape Flattery or off the Columbia, this is a western shore and it's the worst kind of a shore that you can build something on, we have certain historical evidence to go on, if you remember the Texas Towers that were built off the east coast, they didn't stay there very long, this is the kind of problem you're going to run into, but it's worse on the west coast. This is very much in the developmental stage, I'm not predicting that it will or it won't, but I would like to say in my own opinion Discovery Bay up here is an awfully good piece of real estate.

MR. CLARE: Any other questions?

(No response)

Thank you again.

We'd like next to hear from Mrs. Denton Sherry, she will speak to us today as a representative of the Save the Ports Committee. Is Mrs. Sherry here? We're glad you're with us, Mrs. Sherry.

MRS. DENTON SHERRY

MRS. SHERRY: I find it won't be necessary to give half of my speech as Mr. Durning so aptly took care of it for me.

/Ed. Note: Complete text, appears in Part II, p. 104/

Given that industry is desirable for overall development of an economic community, there remains the problem of deciding which particular site in the locale is most appropriate for development. The problem is, of course, one of balancing the conflicting interests, a value judgment not particularly suited for determination by a local zoning board. Local officials are continually under the political pressures of the majority of constituents, whose property interests will not be directly affected by industry's location. Confronted with the obvious desirability, on the one hand, of locating industry somewhere in the district, authorities seldom find insulation from the pressures of immediate economic advantage. At the same time, zoning authorities usually lack the broader perspective required to give weight to the counterveiling interest, a perspective which can only result from a specialized working knowledge of the technological considerations involved. Understanding the enormous complexities created by the interaction of fresh and salt waters in the estuarine situation requires the specialized activity of a group concerned only with this narrow problem.

Yet, at the same time that a broad perspective is required, the problems presented by the selection of one particular site or another are very much individual. The selection of a site for industry's location must be made on the basis of an evaluation of the peculiar problems of individual water conditions, and this is our situation on Port Susan. In particular, the satisfactory presence of existing oil refinery sites at Ferndale and March's Point is of little precedential worth in evaluating the merits of location of similar operations in the Port Susan area. The Ferndale site, enclosed on three sides, and the March's Point site, near a rapid current exchange, offer relatively free circulation. On the other hand, Port Susan is at the end of an arm where there is very reduced tidal exchange.

There are frequent occasions where the water in Port Susan undergoes little replacement or interchange with surrounding waters. Strong southern winds often blow right into Stanwood. Refineries at best should be by open water, not on a "deadend" bay where the tide flow is confined and where beaches can be so easily ruined. Certainly open water conditions do not present the same problems as are encountered in estuarine areas, and recognition of this crucial distinction can only be disclosed upon careful analysis of the particular situation.

Of critical importance in determining the particular location of the industry is the recognition that spillage and possible consequent pollution can result more often from inevitable accidents than from the conscious design to retain substandard operations. Pollution due to accidents may result from pipeline ruptures, vessel groundings, or from human failure in transfer operations. The growing number of major oil spills from marine cargo operations is a present fact. The presence of water pollutants may affect the health of the entire community, as well as necessarily cause extensive property damage to beaches and determine the lives of marine inhabitants. Coupled with the inevitability of accident, and the serious consequences to marine life and property interests, is the present inadequacy of the after-the-fact "mopping-up" approach to solving the problem. Although these techniques are improving, they are presently inadequate when emergencies do occur. Consequently, it is of primary importance that the site of such a potentially dangerous land use not be located in an area characterized by weak tidal currents, slow interchange with surrounding water, southerly winds which hold surface water in the area, and bottom water which mixes and moves even more slowly. The initial location decision must, because of the present state of the art of "mopping-up," be relied upon to mitigate the damaging effects of the inevitable accident.

In short, the situation dictates a preventative approach. Environment-affecting decisions must be more carefully and intelligently made. Choosing between available alternative land uses requires the development of long range policies geared to balancing all conflicting interests. In addition to long range planning and formulation of general policies, intensive studies of particular estuarine areas must be undertaken to disclose individual problems created in various tide flow situations. To minimize the damage done by the inevitable accident, zoning authorities must not proceed until the results of adequate in-depth studies are available for their careful examination. Only in this way, by initially locating industry where its damaging affects can be minimized by the natural flushing operation of the environment itself, can we be assured that our estuarine areas will be protected, so that destruction of our recreational facilities need not be the price paid for industrial development.

MR. CLARE: Thank you very much. Are there any questions from the panel?

(No response)

MR. CLARE: Thank you.

Next we'd like to hear from Mr. Arthur H. Yoshioka, who is from the Port of Seattle, and I suspect that Mr. Yoshioka would probably be in attendance at this Northwest Rivers and Harbors Congress if it had not have been for this, we appreciate your coming.

ARTHUR H. YOSHIOKA

MR. YOSHIOKA: Thank you very much. I have a transmittal letter here signed by J. Eldon Opheim, General Manager of the Port of Seattle, to which is attached a statement. /Ed. Note: See Part II, p. 97/

The Port of Seattle which is a public agency directing multiple purpose activities is acutely aware of the interdependence of activities in today's complex society. We are intensive users of Elliott Bay and Puget Sound and highly dependent on this most important estuarine system for carrying out responsibilities in facilitating waterborne commerce, developing havens for recreational marine craft and sites for water-oriented industry. It recognizes the value of establishing limits and controls to enable estuarine ecology to preserve or re-establish their regenerative ability. Thus, the Port is presently participating with appropriate Federal, State and Local agencies in preparing a detailed comprehensive study that includes all facets of water-oriented activity in Puget Sound and adjacent land and water areas. The study recognizes both conservation measures and economic development in recommended proposals. Because legislative requirements resulting from the National Estuarine Pollution Study will be closely interrelated with port functions, the Port of Seattle submits the following considerations based on experience, current activities and projected needs.

I think it goes without saying that the Port is looking for a reasonable balance approach to this solution of these problems and to preserve and conserve a very valuable natural resource and it feels then there should be a priority in terms of attempting to conserve and to redevelop and to bring back the former qualities, we think there should be a priority on presently unpolluted natural areas, and the preservation of natural streams should have first attention. Correspondingly, redevelopment and more intensive utilization in areas where existing development has already disrupted the ecological function is logical because of time and cost savings and continuity in community activity.

The pattern of use in estuarine areas has established historical precedent for functional activities that cannot arbitrarily be ignored or disregarded. In certain areas standards have evolved which are in balance with the degree of development but which may vary appreciably with other recognized standards. Where existing standards and practices have been established that provide adequate conservation and incentive to economic development, retention of these may well be warranted.

Regulatory control can be uniform only where similar development and physical factors prevail. Regulations should be scoped to the seriousness of existing or potential problems. Estuarine areas either immediately adjacent or very near to the open sea differ from a vast inland sea like Puget Sound. The inherent problems associated with this or similar bodies of water require specific individual consideration. The deep unrestricted navigable waters of Puget Sound could be considered a unique national resource in view of the increasing size of ships.

Frequently run-off from adjoining streams distribute heavy sedimentation throughout Puget Sound. The extent of this natural sediment type pollution should be recognized when regulatory limits are established for controlled dredging activities. What we're trying to state here that we have a natural pollution in man-created activities should not be penalized over these related such kinds as natural pollution. We are thinking about heavy stream run-off and sedimentation.

Acceptable construction methods should be denoted to dispel baseless fears and needlessly rigid controls of conservation agencies.

The control plan and regulations resulting from the study should be definitive. Phraseology should be couched in clear, straight-forward language so that it is precise and easily understood, not subject to radical interpretive modification.

Care should be taken to assure that criteria for estuarine control is designated to eliminate the opportunity of becoming a competitive factor. Ports, i.e., on the Pacific Coast are very competitive with each other. Unequally applied or developed criteria could give undue advantage to one Port over another.

Any plan should be implemented to prevent delays from over regulation. Procedural delays for proposed activities in existing developments will tend to force industrial intrusion into naturally pure areas. Control regulation should include guards against processing delays. In part, this could be accomplished through simplification of interagency coordination, designation of funding procedures and insertion of reasonable time limitation for participants. I think what this attemptes to say that there is a cost of delay and with the rapidly urbanizing areas increasing land values this could tend to put additional pressure on relatively undeveloped areas which are relatively lower in economic value and costs, that strictly from a land value standpoint we anticipate and we get the feeling that probably too many permit levels are required, we think this should be simplified as much as possible. Because Federal control is to be the key for activities in estuaries, permits should be required at the Federal level only. However, processing and enforcement should contain guards against utilization of regulatory powers for trading approvals or as a negotiable instrument for non-associated activities.

The Port of Seattle is attempting to be a responsible public agency. We are participating with other agencies specifically in terms of a study in methods of taking care of possible or current problems in the matter of steamship waste disposal. The Port of Seattle is responsible for navigational development in the Duwamish Waterway. This channel serves as a shipping channel to a heavily industrialized area and is the primary location for the Port's terminal facilities. Periodic dredging is necessary to maintain authorized project depths and supplementary dredging and filling is anticipated to provide increased depths. The fill will primarily be placed in areas removed from the estuary or in deep water. A study by the U.S. Corps of Engineers has been initiated to determine the need for accommodating vessels of increased draft on the Waterway. The Port of Seattle has formalized plans for extending Port facilities up the Duwamish to meet the most imminent needs. More extensive development and further expansion upstream is essential to meet the navigational needs for long range planning in the Greater Seattle Area. A migratory fisheries run has been maintained in the channel throughout past development.

Designation of the entire Puget Sound as an estuary would involve all water-oriented Port activity for consideration. However, encroachment on marine ecology would be limited to shoreside developments of deep water terminal facilities and small boat harbors.

Collectively, with other interested groups, the Port of Seattle is participating in a study to facilitate disposal of waste oil from steamships and other navigation craft.

Sewage collection and treatment is soon to be accomplished for all shoreside industrial and terminal facilities.

In conclusion, the Port of Seattle urges that the formulation and implementation of estuarine pollution control:

(1) Recognize a reasonable balance between economic development and conservation.

(2) Minimize disruptive effects to local economy and enterprise.

(3) Establish controls that reduce involvement rather than just add another layer of permits and approvals.

MR. CLARE: Are there any questions?

MR. BEHLKE: I would like a question on your point number two, maybe I misunderstood you, but I felt that you said it was when an estuary was built up where water quality has been substantially depleted due to the cost involved to clean this area up it should be left that way?

MR. YOSHIOKA: Would you restate that?

MR. BEHLKE: Your point number two, I don't know if I understood this exactly, talked about the build up of areas in certain estuaries and there is a substantial cost to potentially cleaning these areas up or changing them these should be left as is.

MR. YOSHIOKA: I think the emphasis was on the natural areas and they should receive the higher emphasis.

MR. BEHLKE: That was your point number one, what was the second point, this is where you talk about the build up areas.

MR. YOSHIOKA: Are you referring to where I made reference to the historical precedent?

MR. BEHLKE: I wonder if you'd explain this again, I didn't quite understand where you wanted these estuaries whether a substantial build up should be left pretty much as they are or cleaned up or what.

MR. YOSHIOKA: I think we should attempt to clean these areas out, I think correspondingly there should be a reasonable means to accomplish this.

MR. CLARE: Any other questions?

(No response)

Thank you, Mr. Yoshioka, we recognize that you represent a very important agency for important use for the port in estuaries, we appreciate your help.

Next we'd like to hear from Wayne Bishop, who is with the Seattle City Light Department. Mr. Bishop?

WAYNE BISHOP

MR. BISHOP: I'm here to present a statement by Mr. John Nelson, the City of Seattle Superintendent of Lighting. This letter has been sent to Mr. Vlastelicia. Briefly, Mr. Nelson's statement is that it is important to recognize that nuclear-fired electric generating plants are going to be constructed in the Puget Sound region during the next and succeeding decades in order to supply the rapidly increasing demand for electric power in the area.

One of the important uses of Puget Sound and coastal waters would be that of absorbing the waste heat of these nuclear-fired generating plants. The economic value of such use is enormous, and should be carefully weighed when formulating regulations. Signed, Mr. John Nelson.

MR. CLARE: Thank you, Mr. Bishop. Are there any questions?

(No response)

Thank you very much.

It has been suggested we have a break for a few minutes. Before you leave, I would like to announce that the record for this and the Aberdeen meeting will be held open for a period of 15 days, during which time you or anyone who is interested may submit a written statement which will be included in the proceedings for these meetings. I'll ask if you can be back by five minutes after eleven, we have about eight or ten more statements that have been indicated so far that we should hear today, so we probably will continue this afternoon unless we have a late luncheon break, but at any rate, I would appreciate it if you'd be back about five minutes after eleven.

Thank you.

(Recess taken)

MR. CLARE: Back on the record. Let us continue.

The next speaker will be Bob O. Bower, Director of the

Oyster Institute of North America. Many of us have known Bob Bower and he's very interested in the estuaries and we're very happy to have him with us today.

BOB O. BOWER

MR. BOWER: As Mr. Clare said, my name is Bob O. Bower, and I am one of the two Washington State Directors of the Oyster Institute of North America and I present this statement on behalf of the Oyster Institute, a national organization representing the molluscan shellfish industry.

Our industry, more than any other, is aware of the need for a thorough study and inventory of the nation's estuarial resources. Our survival depends upon adequate knowledge and effective protection of these resources. For many years we have been protesting the continued exploitation of the nation's waterways by industrial development and encroachment by an expanding society. The public, generally, has been ahead of its leaders in calling for pollution control and accepting the costs of abatement facilities. The Metro system of pollution control adopted here in Seattle is a good example; however, on the other hand, large industry, particularly the forest products industry, has consistently resisted attempts to enforce pollution control laws.

Here on the Pacific Coast, Samish and Padilla Bays remain unproductive due to industrial pollution. South Puget Sound is slowly recuperating after 30 years of uncontrolled dumping of sulfite waste liquor. This area has been saved only because of the cut-out and get-out philosophy of some timber producers; not because of any effective action on the part of local authorities. Grays Harbor is still grossly polluted by industrial wastes and probably will never regain its former productivity either of shellfish or anadromous fish. Willapa Harbor in Washington and Yaquina Bay in Oregon both have shown declines, part of which is attributed to industrial pollutants. Pollution of these areas by the forest products industry is adequately documented in Pollution Control Commission Technical bulletins.

Faced with a population that is not just expanding but exploding, the value of an estuary for production of protein food cannot be over estimated. It is a proven fact that an acre of oyster land under non-polluted water will produce more pounds of protein per year than an acre of upland used for beef production. Culture of marine animals of all types for food is just beginning to be understood and given clean waters can become an increasingly more important segment of the economy. The future of Washington's coastal zones for recreational purposes, as well as food production, appears most promising if adequate pollution control measures are taken now.

The best uses of our estuaries are obviously those uses which are compatible with each other and leave the waters unsullied for the use of future generations.

The system of management which will best provide for conservation and development of our estuarine resources must include constant forceful superintendence by the Federal authorities to prevent a continuation of the conditions that have prevailed here for 30 years where mammoth corporations continue to fight establishment of controls. One example of weakening under political pressure is submitted:

> The Summary of the Conference on Pollution of Puget Sound (State and Federal) dated October 6, 1967, states, " . . . the conferees unanimously adopted the following recommendations: Georgia Pacific Corporation at Bellingham shall ...
> b. Design and construct facilities to limit sulfite waste liquor discharges. These facilities to be completed and placed in operation no later than Sept. 30, 1972."
>
> Another section states, "They shall provide a submarine outfall with adequate diffuser to be completed and placed in operation no later than Sept. 30, 1970."

The Georgia-Pacific waste discharge permit issued May 27, 1968 states, "Permittee shall complete construction of said facilities and place same in operation by May 15, 1973." and, "Within six months from May 15, 1973 the permittee shall submit a feasibility study for an outfall facility for total mill effluent."

No date for completion of outfall construction is mentioned and removal of existing harmful sludge beds is scheduled for "within six months of completion of the outfall facilities."

On May 21, 1968 Governor Evans said, "The waters of this state are capable of carrying more treated wastes than they are now, and efforts by a federal agency to set water quality standards are an impractical and unwarranted assumption of power." On May 30, 1968 the Daily Olympian Newspaper replied editorially, " . . . steps to date are akin to sending a team armed with teacups to dip out the contamination... In this state we must act now to eliminate present sources of water pollution and refuse to yield to pressure to tolerate new ones in the name of progress."

We agree with the Daily Olympian.

And I have been asked to submit for the record a statement for the National Fishermen & Wives Association, Dave Milholland, President, Mr. Milholland being unable to be here today, he just returned from fishing in Alaska.

"The National Fishermen and Wives Association recommends that, in regard to those waters which extensive tests have shown to be grossly polluted by industrial wastes, (i.e. Columbia River, Chehalis River, Grays Harbor, Bellingham Bay and others) the Federal Government institute managerial procedures which will insure reversal of the marine life damages already incurred and commence rehabilitory programs aimed toward returning these areas to at least some semblance of their former productivity. It is recommended that these managerial procedures and rehabilitory programs be financed, at least in part by assessment of damages against those industries found to be responsible for the pollution present.

It is further recommended that where present productive waters are threatened with marine damage by the installation of polluting industries (for example, the Port Susan area) that the State and Federal Governments, rather than abrogating authority to County Commissioners, assert their respective jurisdiction and serve unequivocal notice that polluting industries will be required to sustain costs of rehabilitation or replacement of fisheries resources lost to industrial pollutants. Respectfully submitted, Dave Milholland, President."

Thank you.

MR. CLARE: Thank you, Mr. Bower. Does the panel have any questions? Mr. Vlastelicia?

MR. VLASTELICIA: Mr. Bower, in your talk today you mentioned at least one point about the ineffectiveness of local agencies to control pollution, and in the second presentation you mentioned at least a broad statement there about the federal and the state role here, but not too specifically mentioned. Do the Fishermen & Wives Association and the Oyster Institute --

MR. BOWER: They favor, when I talked to Dave over the phone over the statement, he said he felt definitely that this was an abrogation of authority to allow the County Commissioners to decide whether or not this plant would go and where it was going to go and everyone seems to be fairly certain that's going to result in some position, they felt that the state has authority and the federal government has authority to exercise it. An example has just come up today, is another example of how this thing can happen. The Weyerhaeuser Company wants to do extensive dredging in Henderson Inlet in South Puget Sound. As owners of oyster ground immediately adjacent to the dredging area we requested that they dredge only on outgoing tides, we objected to the Army authorities, apparently the Washington Pollution Control Commission will not even have an observer there when this is going on; the Army referred the Weyerhaeuser man to us, so we're supposed to get together and decide what can be done. We have no objection to this procedure, but we do think that the people in authority should know what's going on.

MR. VLASTELICIA: Do you see any particular roles? What I'm getting at is any particular roles for the federal, state and local agencies?

MR. BOWER: We think that actually nothing has really been done yet in this pulp mill pollution controversy, there's been a lot of stuff on paper, but we think there wouldn't have been this much on paper if the federal government had come in, there's a tremendous political pressure for the state authorities, almost not as big as the Association of Pulp Industries. I realize the problems that some of the state people have had in the past, particularly when I had a meeting with Governor Evans between the last session of the legislature and the special session and my whole conversation was recorded and I knew it was going to be played back, so there is a tremendous pressure being placed on the state officials. I think we have had several excellent directors. I think Mr. Behlke is technically qualified to be an excellent director, but he can't do anything unless he's allowed to do it by the higher ups. We think those in authority should push the higher ups to get it done. It's pretty good stalling when Bellingham and the rest of them were first ordered to clean up within three years from 1956, now it's up to 1973.

MR. CLARE: Thank you, Mr. Bower; any other questions?

(No response)

I would like to recognize the presence of the Regional Coordinator of the Department of the Interior, the Office of the Secretary, Mr. Dwyer, Mr. Joe Dwyer. Thank you, sir.

Next we will hear from Dr. Max Katz, and I understand that he is presenting two papers, or representing two agencies; he is with the College of Fisheries, University of Washington, he's going to speak for the Washington State Sportsmen's Council and as an individual, and if that's not correct, will you tell us whom you're speaking for.

MAX KATZ

DR. KATZ: Well, thank you for the plug. I am with the University of Washington, but I'm mainly making two statements, the first is going to be for the Washington State Sportsmen's Council, the second, which might be diametrically opposite to the first statement, is for myself as an individual, and I will repeat that a couple of times in the talk in case there are any sportsmen here to make sure of where I stand.

I am Max Katz, a member of the Seattle Chapter of the Izaak Walton League of America. I was informed by Dr. VanDriel, President of the Washington State Sportsmen's Council, that I am the water pollution chairman of that organization. Dr. VanDriel asked me to make a statement expressing the position of the Washington State Sportsmen's Council. This position can be best expressed without any further embellishment on my part by the following resolution, which was passed by the Washington State Sportsmen's Council, to-wit:

"NOW THEREFORE BE IT RESOLVED by the Washington State Sportsmen's Council in convention assembled this fourth day of December, 1966, in Vancouver, Washington, that it hereby expresses its belief that it should be a policy of the Federal Government to coordinate its effort with state and local governments to identify those estuarine areas which are valuable for sport and commercial fishing, wildlife conservation, outdoor recreation, and scenic beauty, and to preserve, protect, manage, and, if possible, restore them for the benefit of all the people through the establishment of a national system of estuarine areas."

The previous statement that I made was for the Washington State Sportsmen's Council. I now wish to speak for myself alone as a citizen, and as a sportsman. I believe that I am a particularly well-informed citizen in regard to the biological aspects of water pollution because I have worked in this area, with some small interruptions, since 1946. In addition, I am a practicing sports fisherman. I practice a lot, sometimes I catch one. Again, I wish to make it clear that this portion of my statement reflects only my views as a citizen, it is not the view of the Washington State Sportsmen's Council, it is not the view of the Seattle Chapter of the Izaak Walton League, of which I am a member, it is not the view of the University of Washington, and I am not being paid to make this statement by any industrial company or industrial association. I was not asked by anybody to make this statement. I hope that is clear.

Now my several years of experience in the water pollution field have alerted me to look for the sleeper in any attempt by any federal bureaucracy to engage the attention and support of the general public. The second page of the letter entitled "Guidelines for presentations at public meetings on impacts of pollution on Washington's coastal waters, June 23 and 25, 1968" contains the "sleeper" or trick question or "the skunk in the woodpile." This is the letter I got from Mr. Poston's office, page two, those of you that have this might like to refer to it.

The guidelines for the meeting are so written, however, to prevent discussion of the sleeper. I refer to guide number three: "Statements should be concise and based upon the subjects of estuarine pollution and its effects on beneficial uses," and there's another sentence in there, "It is suggested that lengthy statements be filed in writing for inclusion in the meeting record, and a summary of the statement presented orally."

I decline to follow the Federal Water Pollution Control Administration guidelines because I want to discuss the question suggested in the same letter sent out by the FWPCA which is up here, number five, close to the top of the page, and it states, "What system of management -- local, state and federal -- would best provide for conservation and development of Washington's estuarine resources."

My discussion will be confined for the most part to administrative policies. First of all, I believe that we can dismiss local management. Local management of our estuaries and fish and wildlife resources has proven to be impractical in the State of Washington and throughout the rest of the United States. For example, it was in the 1930's that the State of Washington gave up the county system of fish and game management and established the Washington State Game Department in its present form and this Department has done an outstanding job.

I might observe, however, that a group of municipalities in a single water shed has done an outstanding job regarding estuarine water quality in the State of Washington. The municipality of Metropolitan Seattle - Metro - is recognized internationally for its excellent program and accomplishments.

I maintain that the State of Washington and the State of Washington alone should maintain strict control of its estuaries, its rivers, and its lakes. The Washington State Department of Fisheries, the Washington State Department of Game and the Washington Pollution Control Commission are excellent organizations and are doing, and have done, an excellent job. Now it is true that they could do better, but they are hindered, as is every state agency, by budgetary limitations. If we are dissatisfied with their performance, I suggest that we can let our feelings be known, and you might notice earlier this morning there were two political candidates that were up here making a statement and to give you some idea that they are interested in this problem and we can instruct our elected representatives in Olympia to pass the tax bills that will give them the funds and the personnel to cope with their ever increasing work load.

I am bitterly opposed to the intervention of another federal agency in our waters. In this case today, I oppose the intrusion of the Federal Water Pollution Control Administration, an aggressive ambitious agency, who, if they succeed in their aims, will regulate the waters of Washington State from the desk of an engineer in Washington, D.C. We have seen what the Federal engineers belonging to other agencies have done to the fisheries and wildlife and resources of the Columbia River. I don't want to see another group of Federal engineers try to cut out an empire at the expense of the rivers, streams and estuaries of the State of Washington. Now some of you may protest why am I talking about rivers and streams when the discussion has been limited to estuaries. Now of course I may be mistaken, but my past experience indicates that the Federal Water Pollution Control Agency will be able to define estuaries as ranging from the snowfields and glaciers of our mountains to the outer limits of our continental shelf.

(Laughter)

Otherwise, they will ask how will they be able to handle the assignment they hope to get, that of regulating our estuaries, unless they control the sources of our estuarine waters which, as you know, are derived from our streams and from the waters of the Pacific.

Where are the policies for the regulation of our estuarine waters going to be made if another Federal agency takes control? It is true that there is a regional office of the FWPCA in Portland, Oregon. But the orders and policies that will affect our fish and wildlife will come from the desks of engineers and not biologists located in Washington, D. C. and these orders and policies will reflect what the functionaries in Washington, D. C. feel is best for the Federal Water Pollution Control

Administration. If these policies happen to be beneficial to our salmon, steelhead, oysters, shrimp and crabs, it will be mere coincidence. The officer in charge in Portland in order to survive must follow Washington, D. C. policy.

Now if we as citizens are dissatisfied with the policy of the Washington Pollution Control Commission, and I will admit a lot of sportsmen, fishermen, oyster growers and industrial people are, we can write a letter to the editor of our newspaper and if it is printed, it is read and felt in Olympia. We can bring it up in our Sportsmen's Club and we can refer our complaint to the Director of the Game Department, who is one of the directors, and a very efficient one, of the Pollution Control Commission, and it gets felt and acted upon in Olympia. We can bring it up to the Director of the Washington State Department of Fisheries, who is also a director of the Pollution Control Commission, and we can get action. We can pick up the phone or write to our representative in Olympia or right now the candidate for office in Olympia, and it gets action because he either wants to get elected or re-elected, and we can write to the Governor and we can get action because he too would like our vote. We have a say as an individual.

Now we as sportsmen and fishermen have many avenues to make our wants known to the Pollution Control Commission, as well as to the State Departments of Fish and Game. Our present gripe is that action is not fast enough nor drastic enough and, in many cases, our gripe is warranted but they can only do so much at the level of support that we have given them.

But let us not cut off our noses to spite our faces. Suppose the Federal bureaucracies move in, and when they do move in it will be Federal in capital letters, and state in very small letters. What recourse will we have as sportsmen? When we protest through our usual channels within the state, they will tell us the honest facts, that the Federals will have the control, which they will have. If you then go to the Federal office which is in Portland, and not Olympia, you will get one of several answers. They will try to convince you that it is a state responsibility, which it may be on paper, but it is not in reality. They may tell you that it is a joint Federal and state responsibility, and it will be discussed at the next meeting, whenever that may be, and my guess will be that the state will not call the shots at these meetings.

You will give up in frustration at this level and go directly to the great white father in Washington, D.C. Now round trip airline fare is about $300 tourist and hotels and meals in Washington, D. C. are expensive, but cabs aren't bad incidentally, but as we all know, our clubs and associations have all kinds of money to spend for activities like this. If by a miracle you fight your way through all the public relations men, and they are paid to make sure that nuts from the far west, and when we get that far we're nuts, do not disturb the great thinker in the Federal Water Pollution Control Administration office. You may get 15 minutes of his time if you are lucky. Now this great man who is used to handling nuts, will discuss things very politely with you for awhile, and very courteously thank you, breathe a sigh and get back to his work.

Our only hope under Federal control is that we have a powerful Senator or Congressman that can put the squeeze on if he is the chairman, or a very influential committee-man of the committee that handles the purse strings of the Federal Water Pollution Control Administration. In other words, we have two chances in a hundred that a Senator from Washington will have the power to help us if he agrees with us and he has the time. We have 98 chances in a hundred that the Senator could care less, and God forbid, for example, that the big man, the Senator, is from one of the southwest states who is trying to get our water.

When the Federal bureaucrats take over, of course that is their definition of cooperation, we can say good-bye to many of our fish and shellfish management programs and we saltwater sports fishermen have the alternative to try for the hatchery trout on opening day and fortunately the State Game Department has an excellent program so you will be able to get your fish.

We must be constructive, and I aim this primarily at our industrial community. Go to bat in Olympia and fight for a strong competent and professional -- well, let's put it more strongly, competent, professional Pollution Control Commission and give them more funds to get more good water resource specialists, more good biologists, and more good scientists and engineers, and I'll give a plug to the biologists as long as I have the podium. We, the sportsmen, and you who represent industry, can talk to Olympia and even if Olympia is slow, we can make progress there.

I talked to Senator Warren Magnuson about this problem last week, I nailed him on the airplane so he couldn't get away, and he agreed with me that the Federal agencies feel that they can move in because the states are weak.

Let us fight for a strong state agency who will represent the State of Washington. Federal control will not solve our problems. Again, let us not cut off our noses to spite our faces.

Thank you.

MR. CLARE: Thank you, Dr. Katz, you made your point very clear and there probably are some questions from the panel.

MR. WASTLER: I have one, I rather hesitate. What do you feel that the role of the Federal government should be in water pollution control?

DR. KATZ: I feel that the role of the Federal government in water pollution should be technical guidance, should be support to the universities in the terms of research grants and research contracts, and should very reluctantly come into the state, and I say very reluctantly come into the state when they are asked by the state, because many of the requests may be, you might say, in the nature of family squabbles instead of genuine problems that need the help and abilities of the Federal agency.

MR. WASTLER: You feel that the role of the Federal government should be primarily technical assistance and financial support?

DR. KATZ: Technical assistance and financial support first and very reluctantly moving into the areas where they are asked to by the state or where there is some technical problem that the states cannot handle, in other words in a river or some area which forms a border of two states which the states cannot handle by themselves and the problem is technically too great, in other words both states together don't have the resources to do an adequate study.

MR. WASTLER: Do you have any thoughts about the management of the international estuaries, such as the other part of Puget Sound for example.

DR. KATZ: If the Province of British Columbia and the government of Canada and the State of Washington agree that the advice and assistance and cooperation in the full use of the word cooperation is warranted, then the Federal Water Pollution Control Administration should come in with the governments of Canada and help the states do the job.

MR. WASTLER: Thank you.

MR. CLARE: Any other questions?

(No response)

MR. CLARE: Thank you again.

Next we'd like to hear from John E. Ward, who is a representative of the Public Utility District No. 1 of Snohomish County. Mr. Ward is with R. W. Beck and Associates in Seattle.

JOHN E. WARD

MR. WARD: The Clean Water Restoration Act of 1966 is necessarily general in its language since it must have national application. Congress has charged the FWPCA with the task of identifying the actions needed to assure wise use of the total resources of our coastal zones. Standards must be set having due regard for specific requirements of the region.

Of particular importance in considering water standards is the pending introduction into the Pacific Northwest of a considerable number of thermal power plants, a number of which will be located on estuarian waters. This is a new development in the Northwest power industry made necessary bythe almost complete utilization of the available economic hydro sites. The Bonneville Power Administration has estimated that even with the continued development of existing and available economic hydro sites, this region will reach a point in 1974 where power demand will outstrip power production capability if additional sources of power are not developed. The thermal plant will have to provide the additional electrical energy required to continue the economic growth and attract industries that provide jobs. There is no other source of power available to meet our needs.

The power demands of this area are estimated to require the addition of at least 1,000,000 kilowatts of generating capacity each year commencing by 1974 at the latest - this is the equivalent of adding two Bonneville Dam Power Houses each year - and this growth will double by 1985. Therefore, it is not a question of if or when thermal plants will be built, but one of where and how they will be built and how large they will be.

Lacking abundant coal or oil resources, these thermal plants will be nuclear-fueled. From a pollution standpoint the nuclear plant is clean in operation - emitting no smoke or odors, and discharging no oil, dirt or filth to our streams. The prime concern, from an environmental standpoint, is the waste heat that must be rejected from a thermal plant. Approximately one-third of the energy generated by the nuclear reactor is converted into electrical energy - two-thirds of the reactor's energy ends up as waste heat, removed from the plant by the source of cooling water. This heated water discharged from a power plant has been termed "thermal pollution". This is an unfortunate term because heat added to a body of water is not pollution just because it is heat. It can enhance the productivity of many species of fish and shellfish as well as being harmful to others. In England, waste heat from nuclear plants has been shown to increase osyter growth rates, accelerate the growth cycle of certain fishes and sea plants. Experiments are planned to use waste heat to control the ocean temperature in restricted areas for the specific purpose of growing certain fish and plants in what amounts to "ocean farms". Warm water irrigation is another area where the "thermal effect from heated waste" may indeed be a benefit. When heat produces a benefit it should not be termed "thermal pollution".

In any case, we must have thermal plants to provide the required power for this region, and these plants must reject large quantities of heat.

There is much that can be done to minimize the effect on the water environment by careful design of the water discharge piping system. Cooperation and ready exchange of information between the designer of a thermal plant and the many state agencies concerned with the environment and its uses can result in a plant designed to operate in harmony with other interests - industrial, fisheries, recreational, etc. Each power plant site poses unique challenges to the engineer and ea ch must be designed to operate in harmony with a unique set of local requirements. Therefore, the regulations established should recognize that standards imposed in one locality may be too rigid or too lax for another. Each plant and its location should be looked at by the regulating agencies to determine what its effect on the environment may be, together with the interactions and cumulative effects of neighboring water users. Then standards can be devised that will maintain acceptable water quality while not arbitrarily imposing higher standards unnecessary for that locality.

This kind of flexibility in devising water standards, particularly temperature standards, will permit the regulatory agencies to weigh the importance of the needs and requirements of all the water users and thereby establish fair and equitable standards.

Thank you.

MR. CLARE: Thank you, Mr. Ward. Now I'm sure there'll be some questions. Mr. Behlke?

MR. BEHLKE: I had a feeling that through your discussions you indicated that we would develop standards around the sites rather than looking potentially at other sites; what do you think the interests of power has here or the companies developing nuclear power plants in determining the site location, what are the guidelines on site locations, is this strictly transmission thoughts or what other factors are involved?

MR. WARD: Many other factors, I misled you if I suggested we would pick the site and try to make it fit; transmission loss is one. In nuclear plant siting, of course the primary requirement is a good foundation suitable to support the plant during normal and seismic activity. The second requirement is large quantities of cooling water, and this is where we butt heads against many of the departmental agencies. I'm merely trying to point out that we must look at a proposed site and as I mentioned the cumulative effect of other users in the area, in addition to the possible expansion of that site as a generating facility when we determine standards and not apply standards to a plant say on the ocean that had been developed for a

Columbia River site.

MR. CLARE: Any other questions?

MR. WASTLER: What do you feel would be the role of industry-wide groups and estuarine management of the natural resources? I don't mean any individual company, I mean industry-wide groups and professional organizations.

MR. WARD: There are industry-wide groups working on pollution studies and the effects of thermal pollution specifically, the Edison Electrical Institute is doing extensive studies and many of the power companies are cooperating with FWPCA's lab at Duluth and several other plants to determine what the standards are, what the effects are of thermal discharge.

MR. WASTLER: Thank you.

MR. CLARE: Mr. Ward, I think I have a question about your other alternatives to the solution of this problem and discharge of uncooled heating water.

MR. WARD: There's no alternative to discharge of heat, there are other ways to discharge heat than dumping heating water directly into the cooling water source, yes; cooling towers have had lots of play in the discussions recently, but cooling towers merely, well, cooling towers have two problems associated with them, first of all they discharge the heat primarily through the atmosphere and we're just shifting the problem from a water pollution problem to an air pollution problem and there is a certain amount of vapor and fog generated in areas where the atmosphere is close to the dew point such as coastal areas, the cooling towers are large users of water in themselves, they must evacuate considerable quantities of water in order to provide the cooling effect so you get into another problem of water diversion.

MR. CLARE: I suppose another disadvantage would be the cost, could you give us some idea of the percentage of the cost of a total thermal power development which would be charged against cooling towers?

MR. WARD: It has been estimated the figures given by Gen. Kitchner at the Richland meetings developed by Portland Electric, a factor of $10 million of cooling installation of a thousand megawatt plant.

MR. CLARE: And the cost per plant?

MR. WARD: A hundred and thirty to forty million dollars.

MR. CLARE: No less than ten per cent.

MR. WARD: Oh, yes. The other item that hasn't been discussed is the cooling tower in operation evaporating a considerable number of or amount of water leaves a considerable amount of solid deposit and this must be cleaned chemically and then you have the problem of what do you do with the chemicals that you clean out the tower.

There are many problems to cooling towers, they are not the answer.

MR. BEHLKE: And the many problems to nuclear power plants, these are not really a simple type of facility in the first place.

MR. WARD: Not at all, there are many problems with the plants, the plants are fairly new in design, that is in the operation of the large plants, as I stated they reject a lot of heat because they are not efficient in the conversion of thermal energy into electricity; improvements are on the way, but they are in the design and development stage and not in the practical stage as the light water reactors are today.

MR. CLARE: Any other questions?

(No response)

Thank you very much, Mr. Ward.

We would like to hear next from Harry R. Fulton, who is Director of Planning of Whatcom County Regional Planning Council with offices in Whatcom County Court House in Bellingham. Mr. Fulton?

HARRY R. FULTON

MR. FULTON: Thank you very kindly.

I have been entrusted by the Whatcom County Regional Planning Council for the delivery of this statement. The Council is a representative group of all the local governments in our county, the city, the county and special districts. Its programs include primarily land use planning and development of implementation programs for this and these plans. Secondly, we're engaged in a county-wide comprehensive water and sewer planning program along the lines of the requirements of the Department of Housing and Urban Development which does look into one aspect of your estuarine problem. And three, a program for the next three years which we are hoping to make application for very soon, that is the comprehensive river basin planning program for water pollution under the FWPCA. This will concern itself I think at the outset with drawing together a great variety of rather disjointed efforts being made by various state and federal and local governments and private agencies and academic units as well in an attempt to find out what the overlaps and gaps and the problems would be put together comprehensive calibration of our water shed in terms of the pollution run-off characteristics. You might say that through the state we already have a very good inventory of our resource and through the efforts of the Puget Sound basin task force we have some preliminary indication of the kinds of things that we should be doing, but as I say to design and draw together a comprehensive package is quite a task and we hope that we will be able to work with your estuarine people in this effort and we do feel that this is a very legitimate focus for the local government. Of course the roles of the various levels of government which you're representing depend in great measure on money and we are weak at the local level. However, we do have a microplasm of all the activity of all of the agencies of the government as well as the private sectors. For example, in our county we have a very large oil refinery site, one in operation already in primary metals and in pulp and paper and in power we have international implications and we feel that we have a place for these sort of single purpose efforts being made by a number of agencies which can be put together. I can give you an illustration. Within the past two years I discovered that two federal agencies duplicate exactly the work of taking land use inventory that I had already done the same identical mapping scale merely because of lack of communication; their concerns are largely the same, so there wasn't hardly any difference. This effort does illustrate, I think, a serious concern on the part of the local community and I hope there will be more of them here today.

Number two, I would like to suggest there are three general sources of pollutions and I would like to comment on that. The major source of pollution is sedimentation in the rivers and we find in our community in this situation that an estimate has been made of something like 300,000 tons per day of sediment from a little stream like the Nooksack, it's not a major river and it's rather small, previously an estimate of 40 acres of land topsoil of some depth being washed per year down the river has been made, and I think that's rather conservative. This sediment has been mapped by the U.S. Geological Survey and a comparison of the maps can be made to 1904 to more recent mapping it shows definitely an outward movement of the delta, which is only the top of the iceberg. This material does get in the waterways and needs to be removed and we feel potentially a major problem for the bay, for Bellingham Bay, an acceleration of sedimentation. I think there is a gap in the federal programs concerned with this type of thing. We have found the small water shed planning program, if that's the correct title, the soil and water conservation service program that takes care of certain small water sheds and the Corps of Engineers that looks after flood control and in between we can find very little available concern or help technically for the actual problem of designing bank erosion protective systems as distinct from flood control systems. We feel that the assembly of the various testing and data collection efforts will fit together with this kind of indication once these programs are available, and there are gaps in those programs. It has been mentioned that there is an international aspect and this does concern our county, particularly at Boundary Bay, which lies between the mainland and a Canadian bay for the most part which has been the subject of considerable debate north of the boundary and has been classified for ten years as to whether it should be industrial for industrial uses or remain for wildlife uses, being in the flight path of migratory birds. Also on the other side towards the Gulf of Georgia just north of the international boundary is an extremely large program of reclaiming the shallow tidal area for the construction of deep sea shipping of the kind mentioned here earlier today and immediately hard on our boundary. I would hope that another aspect might bring an international picture to be a real concern, that is the fact that our salt waters are off our coast and throughout our county are overlaid with fresh water from the Fraser River and if anything happens up there it's a direct concern to all of us. The related small harbor at Blaine has some years proposed to be studied to find out if it could be converted into some sort of harvesting area or growing area for fish, probably salmon and oysters, that was the original proposal, now whether this is feasible is a question we've been hoping to find out to get answers to; as yet there has been no success and several efforts have been made to get a study on that. You might say it's just kind of a theoretical proposition to find if there's any study of economics before the planning, if there's any efficient cost of production that we can afford in terms of benefit, it seems to me it's a neglected aspect of this whole business, especially during this last run when the state was setting standards. It's very little really we've found economic basis or possibly even some gaps in the scientific aspects of that as well and we hope to augment that more and more detail. I think the conclusion should be that we will hope to participate with you people if we can obtain this grant in helping you as much as possible, hoping that you people will work with us and help us so we don't overlap and so we can come up with a total job during the next few years.

MR. CLARE: Thank you, Mr. Fulton. The grant that you speak of I understand is one of the planning grants that is provided for under Headwaters Restoration Act, the same Act that called for the studies, is that correct?

MR. FULTON: Yes, it's a 50 per cent matching fund, we are very far along in preparing our application, you might say the Western Washington State College in particular is working with the community in this application, at present they have an institution for fresh water studies and several people are interested in fresh water -- salt water studies that we hope to utilize. I believe also it should be remarked that we are very pleased with this kind of a government program by the federal government to stimulate action at the local level and helps to bear out the interest which is yet I think grossly ungarnished in the State of Washington that the local people have. Recently we did a questionnaire survey and found at least 10 to 15 per cent of our people are more interested in water pollution than they are air pollution and yet because of the difference we've gone farther into air pollution than we have water pollution. I would hope that perhaps a channel by which local people, if they get interested, they may participate, may be explored also.

MR. CLARE: Thank you. Are there any questions?

(No response)

Thank you again, Mr. Fulton.

We have two more speakers who have indicated they'd like to make statements. I'm going to propose that we continue this session, it's now twelve o'clock, until it is completed, if there is no objection to that, I think we'll proceed along those lines.

We'd next like to hear from Conrad Hougen, who is from the Washington Association of Conservation Districts. We always get some good information from this organization. We're glad you're with us, Mr. Hougen.

CONRAD HOUGEN

MR. HOUGEN: Mr. Chairman, I am Conrad Hougen, President of the Washington Association of Conservation Districts, and I am here to present to this committee thoughts and ideas of the Soil and Water Conservation Districts that are relevant to the pollution problems of our estuaries.

The Soil and Water Conservation Districts of the State of Washington have always had as their major concern the conservation of all of our natural resources, and the estuaries of our state are certainly included in this category.

It has been stated many times by professional people that silt pollution is perhaps our number one pollutant. In combating this problem, I believe that local Soil and Water Conservation Districts can, and are, playing an important role by calling on Soil Conservation Service Engineers for technical assistance to help combat the problem at its source, mainly upstream erosion whereby proper stream bank protection and proper land management sedimentation from soil erosion can certainly be reduced.

I firmly believe that all Soil and Water Conservation Districts must be concerned with what the pattern of our river basin developments will be in the years ahead. To plan constructively for the future we must consider all segments that have a bearing on pollution of the nation's estuaries.

This can only be accomplished by identifying the problem at its source. With this in mind I would like to read to you an article from our National Association of Conservation Districts weekly newsletter.

"Sediment, the product of erosion, and a plague to civilization throughout history, is agriculture's major concern in water pollusion. Sediment transported by run-off water greatly exceeds in volume the combined total of all the other substances that pollute our surface water. Volume-wise, such suspended solids in the nation's streams amount to at least 700 times the loadings caused by sewage discharge.

"Virtually all of the phosphate carried by streams is carried on sediment. Most of the pesticides carried in streams are carried on sediment.

"Sediment is a costly water pollutant. It constitutes a heavy economic drain in terms of loss of valuable top soil. It obstructs navigable streams. It damages aquatic life. It imposes a substantial cost on water supply agencies for water clarification. It causes excessive wear on hydro-power turbines and pump impellers.

"The deposition of sediment is depleting the storage capacity of reservoirs in the country at the rate of about one million acre-feet each year.

"Sediment affects every citizen. It means higher water bills, higher food and clothing prices, and higher taxes. Estimates indicate it is costing the people of the United States in excess of one-half billion dollars annually." This is from Hollis R. Williams, Deputy Administrator for Water sheds, Soil Conservation Service. I imagine a lot of you gentlemen know him.

I am from Whatcom County and our main drainage is the Nooksack River. I have seen many farmers stand helplessly by while their valuable farm land has been washed down to the mouth of the river and filling up the Bay with silt.

We have many smaller streams that feed into the Nooksack River. They also contribute their share of pollutants to the main stream.

I am bringing this to your attention, because I believe that Soil Conservation Districts can and should play an important role by calling on the Soil Conservation personnel in their respective districts for stream bank and erosion control plans, also water shed planning to stop this loss of our great natural resource, mainly our soil.

To properly develop our estuaries requires a continuing study and can only be accomplished by the combined efforts of all parties concerned. We must coordinate our efforts to achieve the desired result, which is to use the estuaries for their most beneficial use, and that must include all segments such as industry, recreation, fishing, picnicking, or any other use they may be needed for.

I conclude with that, because I don't know what else to say there, but I had a lot more, but I had the information five minutes we would be allowed to talk, so I decided to shut it off.

MR. CLARE: We appreciate that very much, Mr. Hougen. There may be some questions from the panel.

(No response)

Thank you very much.

Next we'd like to hear from C. S. Sargent, Association of Washington Industries from Olympia. Mr. Sargent?

CHARLES S. SARGENT

MR. SARGENT: My name is Charles S. Sargent. I am appearing in behalf of the Natural Resources Committee of the Association of Washington Industries, of which I am a member.

The industrial interests of the State of Washington concur in the need for long range planning in connection with the protection and development of our estuaries to serve public and private needs in the best possible manner. However, we wish to point out that much information already exists regarding quality of the waters of the Puget Sound basin and we would hope that this information would be used rather than duplicating the substantial effort already expended.

As you are undoubtedly aware, Puget Sound is probably one of the most studied, sampled and analyzed bodies of water in the United States. Only recently a 1.5 million dollar five year study of the estuaries near the sulfite pulping industry locations was completed by the Federal Water Pollution Control Administration, and an extensive water quality control program recommended. Also, final drafts are currently under review of the report on a comprehensive planning study over the past several years by the Puget Sound and Adjacent Water Task Force, again deeply involving the FWPCA, the Washington Pollution Control Commission, and other Federal and State Water Resources agencies. This study should help answer questions about the value of and provide a future guide to the best uses of estuaries.

Many local agencies have studied the estuaries of Puget Sound and plan further work to build the bank of knowledge about them, such as the Departments of Oceanography, Engineering, Fisheries Research Institute and Water Resources Institute at the University of Washington, the State Department of Fisheries and the Water Pollution Control Commission. Besides these groups, the Pacific Science Center is mobilizing an oceanographic research arm for future work, in addition to Metro of Seattle, and industry continues to support sizeable study budgets for monitoring and special contract studies in the Sound. The State Department of Water Resources is considering additional work in this area.

With all this data gathering and research activity focused on Puget Sound and its estuaries, we hope that you and the Congress will carefully consider the extent of duplication inherent in another program to study this body of water.

Any program for the management and development of the estuaries of the State should be under State control. Federal support should be provided as in the water quality and air quality programs, in the form of technical data and matching funds.

There are already in existence, in the State of Washington, agencies dealing with water resources which are well equipped to administer such a program. The State has an active Department of Planning and Development and Fisheries and Game Departments. The Water Pollution Control Commission is well staffed and has received good budgetary support from the Legislature.

Water quality standards have been established by the Pollution Control Commission and approved by the Federal Government for all of the State's waters including the

Puget Sound areas, and an implementation plan covering the next five years has been spelled out.

It would seem reasonable that the results of these new forces on the waters of Puget Sound should be observed and assimilated before another study is launched.

We recognize that estuaries pose a particularly difficult problem of analysis to adequately assess the demands and arrive at a proper allocation of all uses to provide the greatest long range benefit.

Since the waters of Puget Sound and its estuaries constitute a marine system with great assimilative capacity, we would caution those who advance the thesis that these areas must be protected against all discharges of waste, because of the resultant pressure that would prevail on our other resources to accept these materials.

Adequate treatment and dilution and due caution regarding the effects of residual discharges into estuaries are of course necessary and required, but the use of these resiliant waters for such discharges must be considered on a par with all other uses in light of the alternate and much less desirable opportunities for industrial sewage treatment plant outfall locations.

It is our firm belief that any program for the management of our estuarine areas should give consideration to development to meet the needs of industry, commerce, fisheries and local governmental bodies, as well as recreation and all other uses in determining the allocation that will result in the greatest benefit to society, and that such a program should be carried on by State agencies with appropriate Federal support.

Thank you.

MR. CLARE: Thank you very much. Are there any questions?

(No response)

MR. CLARE: Thank you, sir.

That is the last card that I have of those who indicated that they would like to make statements. I would like to ask at this time if there is anyone here from Metro of Seattle who thought that they might want to present a statement. I had one indication from Mr. Zickefoose that our notice to Metro of Seattle might have gone astray and been lost, I hope that Mr. Vlastelicia will get word to Mr. Gibbs of Metro of Seattle that they can attend the Aberdeen meeting and if they want to make a statement they will be welcome.

Are there any others here who would like to make a statement?

(No response)

We appreciate very much your attention and your help, the statements have been very helpful and I'm sure they will be an important part of the report which our secretary will present to the Congress in 1969.

Thank you again for coming, and if you come to Aberdeen Thursday you'll be most welcome.

(Whereupon, at 12:15 o'clock p.m., Tuesday, July 23, 1968, the hearing in the above-entitled matter was adjourned.)

PART II

WRITTEN STATEMENTS

STATEMENT OF THE HONORABLE THOMAS M. PELLY (R.Wash.) BEFORE THE NATIONAL ESTUARINE POLLUTION STUDY HEARING OF THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, SEATTLE, WASHINGTON.

JULY 23, 1968

Mr. Chairman, ladies and gentlemen:

I welcome the opportunity to submit my views in the interest of our Nation's estuaries to this distinguished gathering of conservation minded citizens. I only regret that due to an unusually busy schedule of pending legislation in the Congress, I am unable to be there in person to exchange ideas with you. I would, however, like to express my interest in your mission and my wholehearted support of any movement to preserve our Nation's priceless estuarine areas.

Our great Nation has been blessed with an abundance of natural resources, areas of scenic beauty, and pure water that sustain life and provide many hours of rest and recreation for its swimming, boating and fishing enthusiasts. Many depend upon these estuarine areas for their livelihood. Commercial harvesting of the resources of these areas provides a substantial contribution of revenue for many of our Nation's tidewater states. It is these same estuaries that act as climate modifiers and are responsible for the cool summers and mild winters associated with the tidewater states such as our own great State of Washington.

All of these natural endowments are ours to enjoy -- compliments of Mother Nature. We have contributed no funds to their creation and not until recently have we contributed any of our talent and efforts to insure their continued existence for our own enjoyment.

Man's most recent attempt to preserve this natural endowment is now pending before the Congress. H.R. 25, a bill, designed to provide Federal authority, in cooperation with the states, to study and plan for the protection of our estuarine areas, passed the House of Representatives February 8, 1968 and was favorably reported by the Senate Commerce Committee, July 17, 1968. In essence, this bill would provide for a study to determine which estuaries are relatively unspoiled and should be preserved for future generations to enjoy and which ones have fallen victim to the effects of vast industrial development and are no longer useful from a conservation standpoint. Those areas that qualify will be recommended for inclusion in a national system of estuaries.

It is my sincere wish that this bill will be considered on the Floor of the Senate this month and sent to the President for his signature. Enactment of such legislation would be a giant step toward a realistic attempt to secure optimum utilization of our natural resources and is most urgently needed at this time.

This bill will complement the work we hope to accomplish today. Today's meeting, to study pollution problems in our Nation's estuaries was authorized by the Clean Water Restoration Act of 1966 (Public Law 89-753) and directs the Department of the Interior to made an extensive study of pollution problems in estuarine areas and report their findings to the Congress with recommendations for future management programs. This study is to be completed and submitted to the Congress by November 1969.

The more specific purpose of this meeting is to extract the opinions, desires and suggestions of the local public and private interest groups and individuals who are sincerely interested in preserving our Nation's estuarine and coastal waters. It is hoped that your wishes can and will be translated into suitable legislation and enacted into law.

The dilemma of our estuaries seems to be its high degree of suitability for a variety of purposes. Some are natural and others are man-made but for the most part, they are mutually incompatible. Estuaries that have been filled in or dredged out for commercial profits are no longer suitable sanctuaries to sustain or perpetuate marine life and are rendered useless to the sport and commercial fishermen.

Those of us who have been lucky enough to have lived near one of our great estuaries and enjoyed the scenic beauty, good food, mild weather and healthy recreation it affords us, are well aware of its importance to the economy and well-being of our rapidly progressing Nation. Washington State can boast of having the largest salt water harbor in the world within its boundaries -- Puget Sound. This estuary holds a position of significance in our fine State and we are proud to claim it as our own.

We, of the Puget Sound area, are very fortunate that our estuary has not deteriorated to the point that other similar areas have. I cite our sister state, California, which has lost almost 67 percent of her valuable wetlands to neglect and abuse. The damage is irrevocable.

I am most optimistic that through comprehensive studies, such as this one, we can solve the problem of preserving our wetlands and uncover a program whereby the interests of both industry and conservation can best be realized to the optimum benefit and well-being of both parties. This is the challenge -- we must not fail.

Thank you.

WESTERN WASHINGTON STATE COLLEGE

Department of Biology

A Statement
to the
National Estuarine Pollution Study

Western Washington State College is vitally interested in the maintenance of environmental quality and in all aspects of the complex interactions of human society and our natural surroundings. Our Department of Biology has emphasized environmental biology in both graduate and undergraduate curricula. Courses stressing the environment are offered in many other departments. In 1962 we established an Institute for Freshwater Studies, a research arm of the College concerned with the quality of our fresh water resources. In 1965 we installed on Lummi Island a small marine and estuarine research facility which has developed into a currently planned full-fledged marine laboratory for which land acquisition now is in train. In July, 1968, our Board of Trustees established as an academic unit of Western Washington State College a new college of environmental science within which inter-disciplinary curricula, combining the natural and social sciences, will center upon the several aspects of environmental studies.

These efforts are part of an integrated program designed to make full use of our location in serving the people of the state and nation. No institution of higher education in the United States is more favorably situated for instructional and research programs centered on man's environment. Extending from the peaks of the Cascade Mountains to the shores of Puget Sound, our area embraces a wide range of climatic conditions and ecosystems, virtually a world in miniature. It includes entire river systems some of which remain relatively unchanged over most of their length while others represent various stages of deterioration. To the south and to the north, the population centers of Seattle and Vancouver, B. C. stand as sample areas of urban ecology with its concomittant environmental enrichment, yet between these two lie tracts of virtually inaccessible wilderness.

It is vital to our academic program that the quality and variety of the environment of northwest Washington be maintained. The present concern is for estuaries, and our interest must focus specifically on those of the Nooksack, Skagit and Snohomish river systems. Indeed, even these three offer presently a gradation in deterioration from the Snohomish, already encompassed in the northern expansion of the Seattle urban area to the Skagit which remains relatively wild over most of its length. That such conditions as now obtain at least be maintained is essential. We urge your consideration of the establishment in northwest Washington of at least one completely wild river system from source to mouth to preserve for future study. Without such for comparison much future research on estuaries will be relatively meaningless.

Among the many values of estuaries to educational institutions are the opportunities they provide for studying living organisms in salinity and temperature gradients and widely fluctuating environmental conditions. Other, more obvious values of estuaries (nursery areas for many economically important species) need not be mentioned here.

Damage by pollution is a concept that involves many value judgements. Damage implies the loss or impairment of some useful function, and pollution (or enrichment) is also a matter of definition but implies that damage has been done. An estuary as a natural laboratory, however, is damaged by pollutants of any form (chemical or physical including thermal pollution) if the function of that laboratory is to serve in studies of natural conditions or as a control area for studies of conditions in altered (or polluted) estuaries. As an educational institution, we must regard all estuaries as damaged. Our plea is that at least one be restored as nearly as possible to an undamaged or natural condition.

In addition to serving an ever increasing demand for recreational facilities, residential developments and urban and industrial sites, the future of Washington's coastal zones must include some provision for studies of oceanography and marine science, for in the years ahead we will inevitably turn increasingly to the sea for food, industrial development, recreational use and, perhaps, even mineral wealth. Yet, today, we do not know how to plan or even what direction this development may take. The possibilities of aquaculture in Puget Sound estuaries are just beginning to be seen, for example. Along with possibly more obvious uses of estuaries must, therefore, be included their function as research and development sites in which the marine technology of tomorrow will be developed.

We see one of the best uses of at least one estuary to be in providing a natural laboratory in which these studies may be conducted.

We know of no single best system of estuarine management. Through the sea all estuaries are interconnected and concern, with perhaps the establishment of minimum standards of quality, at the federal level certainly is indicated. Both state and local interest, however, should be encouraged, perhaps through state and local environmental quality authorities similar to those currently in operation. A major responsibility for public concern, however, rests with the educational institutions whose function it is to study and pass on knowledge of our finite resources for only through such can an informed public make wise decisions.

A. C. Broad

A. C. Broad
Professor and Chairman

ACB:bl

AUG 5

Cascade Pass and Orcas Island
31 July, 1968

Mr. Kent Mountford
Department of Botany
Barnegat Project
Rutgers University
New Brunswick, N.J.08903

Office of the Director
Federal Water Pollution Control Administration
Corvallis, Oregon

Gentlemen:

Having attended the morning session of the Public Hearing on Estuarine Pollution at the Eames Theater, 23 July in Seattle, I wish to offer the following comments which, at your discretion you may include or not in the proceedings. Travel plans dictated that these thoughts be drafted in the field rather than presented orally as certainly would have been preferable.

Please feel free to edit them reasonably, or request any changes you feel appropriate. Allowing my non-exposure to the afternoon session, certain portions may indeed be better omitted.

Most sincerely yours,

Kent Mountford

Comment by Kent Mountford, Rutgers, the State University of New Jersey

It must be made abundantly clear at the outset that while as an individual I am concerned with estuarine ecology, and particularly with the problem of thermal addition, I am an outsider to Washington and my observations should not be confused with any official position of Rutgers University. I speak as a concerned American, and as a member of the American Littoral Society, thru which I became aware of this session.

Such a gathering as this is useful as a forum for the airing of community and organizational positions. What emerges to the outsider, however, is a series of platitudes and foregone conclusions with which no one can really disagree, or at least at which no one is surprised. The basic issues seem yet to be addressed.

Threats to the estuary, as discussed this morning could be categorized somewhat as follows:

1. Mechanical disturbances of the environment. Dredging of navigational channels, the filling especially of salt marshes and deposition of spoil on expanses of previously productive benthic substrate lie within this area. Natural patterns of sedimentation and erosion cannot be ignored.

One of the more pressing problems in our East Coast estuaries has been that man in general has ignored natural tendencies in the migration of channels, erosion of our relatively ephemeral sandy beaches and the flood-prone nature of coastal river bottoms (floodplains). If we talk in dollar and man-hour terms, it is highly inefficient to construct massive commercial and residential facilities without regard to these realities and then expend tremendous social and economic energy in maintenance, control, and damage repair. Of course advance knowledge of the system will not solve all our problems, but the disruption of biological as well as human communities (there is, perhaps,a real distinction!)

should be much reduced by intelligent forethought.

2. The addition of substances foreign to the environment, especially those not considered to be reasonably biodegradable, or those added in such quantities that natural processes cannot handle them quickly. The current furor over oil spills, the possible effects of mine tailings in terrestrial runoff, and chemical toxics such as those emanating from the admittedly important pulp industry belong here.

The responsibility here lies squarely on industry, which must realize its own long term advantage in developing different, however costly, methods of handling disposal and effluent problems. Dispersal does not seem an adequate solution to me. We know so little about the actual tolerance of natural systems, that ideally almost no tampering is appropriate. Furthermore, I wonder if considerable amounts of valuable material are not being lost that could be profitably reclaimed as by-products. The sophistication (in relative terms) achieved in "Cracking" crude oil into myriad petroleum products has proven economically quite feasible. Panaceas ? no, but partial solutions at least.

3. Residential and community pollutants, excepting the out-and-out trash category of pop bottle and beer can, frequently involve the addition of materials which inordinately enrich certain nutrient categories in the water column. If you accept the applicability of the term, they accelerate "eutrophication" of the estuary, or at least may play a role in particularly intense blooms.

The effects of such addition must be understood. I believe FWPCA has been giving support along these lines to Dr. G.C. Anderson, at the University of Washington.

4. Circulation problems include altering patterns of movement; the obstruction or introduction of tidal flow, with resulting changes in salinity and the difficulty of dissipating massive thermal additions

such as you have observed along the Columbia, and we are beginning to encounter in some east coast estuaries.

Thermal addition is the result of inefficiencies inherent to the generating process. While thermonuclear plants avoid much direct addition of particulate materials to the atmosphere, they apparently have a much higher heat load that must be dissipated by the condensers. With concern rising for the aquatic environment, some talk has been heard about cooling towers that would lower effluent to acceptable thermal levels before returning it to the source water body. I wonder then at the wisdom of atmospheric thermal pollution. In general, thermal addition is relatively new; we had better study carefully its implications before introductions occur on too broad a front.

Proportionately, the west coast, and specifically the Pacific Northwest, has less disturbed its estuaries than the east. You must look carefully at the mistakes made along our seaboard and whatever the apparent immediate cost or inconvenience, deal directly with the problems.

Unfortunately, the average citizen is rarely touched individually by estuarine encroachment. His personal recreational and economic needs are often served more than harmed in the short term sense. When governmental intervention is introduced the issues are often hopelessly boggled in Federal-State's Rights controversy and the threats to individual liberty about which all of us, as free Americans, should be concerned. The result is frequently inaction, or the servicing of special interest groups at the expense of one or another irreplacable resource.

Perhaps our greatest hope lies with the individual; with deepening his pride in and sensitivity to the delicate systems operating in the natural world. Each of us must be willing to recognize limited buffering capacity in the environment. Only with this understanding can reasonable legislative and administrative guidelines hope to be successful in altering our present catastrophic course.

PORT OF SEATTLE STATEMENT CONCERNING THE NATIONAL ESTUARINE POLLUTION STUDY

Public Meeting by Federal Water Pollution Control Administration, Seattle, July 23, 1968.

The Port of Seattle which is a public agency directing multiple purpose activities is acutely aware of the interdependence of activities in today's complex society. We are intensive users of Elliott Bay and Puget Sound and highly dependent on this most important estuarine system for carrying out responsibilities in facilitating waterborne commerce, developing havens for recreational marine craft and sites for water-oriented industry. It recognizes the value of establishing limits and controls to enable estuarine ecology to preserve or re-establish their regenerative ability. Thus, the Port is presently participating with appropriate Federal, State and Local agencies in preparing a detailed comprehensive study that includes all facets of water-oriented activity in Puget Sound and adjacent land and water areas. The study recognizes both conservation measures and economic development in recommended proposals. Because legislative requirements resulting from the National Estuarine Pollution Study will be closely interrelated with port functions, the Port of Seattle submits the following considerations based on experience, current activities and projected needs.

Comprehensive Considerations

1. Balance between Conservation and Economic Development

National and local agencies, working toward a healthy economy and society should maintain in planned programs a balance between conservation and community enterprise. An essential ingredient to this balance is impartial analysis of all pertinent objectives in their realistic long and short range perspective. New analytical techniques to more equitably measure benefits and values are needed.

2. Limit Encroachment on Natural Streams

Preservation of natural streams should have priority attention. Correspondingly, redevelopment and more intensive utilization in areas where existing development has already disrupted the ecological function is logical because of time and cost savings and continuity in community activity.

3. Recognition of Historical Pattern

The pattern of use in estuarine areas has established historical precedent for functional activities that cannot arbitrarily be ignored or disregarded. In certain areas standards have evolved which are in balance with the degree of development but which may vary appreciably with other recognized standards. Where existing standards and practices have been established that provide adequate conservation and incentive to economic development, retention of these may well be warranted.

Regulations

1. Differentiations

Regulatory control can be uniform only where similar development and physical factors prevail. Regulations should be scoped to the seriousness of existing or potential problems. Estuarine areas either immediately adjacent or very near to the open sea differ from a vast inland sea like Puget Sound. The inherent problems associated with this or similar bodies of water require specific individual consideration. The deep unrestricted navigable waters of Puget Sound could be considered a unique national resource in view of the increasing size of ships.

2. Limitations Imposed by Natural Pollution

Frequently run-off from adjoining streams distribute heavy sedimentation throughout Puget Sound. The extent of this natural sediment type pollution should be recognized when regulatory limits are established for controlled dredging activities.

3. Acceptance of Construction

Acceptable construction methods should be denoted to dispel baseless fears and needlessly rigid controls of conservation agencies.

4. Explicit Terminology

The control plan and regulations resulting from the study should be definitive. Phraseology should be couched in clear, straightforward language so that it is precise and easily understood, not subject to radical interpretive modification.

5. Eliminate Competitive Factor from Criteria

Care should be taken to assure that criteria for estuarine control is designated to eliminate the opportunity of becoming a competitive factor. Ports, i.e., on the Pacific Coast are very competitive with each other. Unequally applied or developed criteria could give undue advantage to one Port over another.

Implementation of Plans

1. Prevent Delays from Over Regulation and Procedure

The plan should be implemented to prevent delays from over regulation. Procedural delays for proposed activities in existing developments will tend to force industrial intrusion into naturally pure areas. Control regulation should include guards against processing delays. In part, this could be accomplished through simplification of interagency coordination, designation of funding procedures and insertion of reasonable time limitation for participants.

2. Reduce Permits

Too many permit levels are currently required. Because Federal control is to be the key for activities in estuaries, permits should be required at the Federal level only. However, processing and enforcement should contain guards against utilization of regulatory powers for trading approvals or as a negotiable instrument for non-associated activities.

Port of Seattle

1. Estuarine Involvement

The Port of Seattle is responsible for navigational development in the Duwamish Waterway. This channel serves as a shipping channel to a heavily industrialized area and is the primary location for the Port's terminal facilities. Periodic dredging is necessary to maintain authorized project depths and supplementary dredging and filling is anticipated to provide increased depths.

The fill will primarily be placed in areas removed from the estuary or in deep water. A study by the U.S. Corps of Engineers has been initiated to determine the need for accommodating vessels of increased draft on the Waterway. The Port of Seattle has formalized plans for extending Port facilities up the Duwamish to meet the most imminent needs. More extensive development and further expansion upstream is essential to meet the navigational needs for long range planning in the Greater Seattle Area. A migratory fisheries run has been maintained in the channel throughout past development.

Designation of the entire Puget Sound as an estuary would involve all water-oriented Port activity for consideration. However, encroachment on marine ecology would be limited to shoreside developments of deep water terminal facilities and small boat harbors.

2. Control Measures

Collectively, with other interested groups, the Port of Seattle is participating in a study to facilitate disposal of waste oil from steamships and other navigation craft.

Sewage collection and treatment is soon to be accomplished for all shoreside industrial and terminal facilities.

In conclusion, the Port of Seattle urges that the formulation and implementation of estuarine pollution control:

(1) Recognize a reasonable balance between economic development and conservation.

(2) Minimize disruptive effects to local economy and enterprise.

(3) Establish controls that reduce involvement rather than just add another layer of permits and approvals.

STATEMENT SUBMITTED BY MRS. DENTON SHERRY
SAVE PORT SUSAN COMMITTEE

The running of any economy, from the allocation of the natural resources of the world's wealthiest nation to the management of the American housewife's family budget, is in its necessary operation a decision-making process. The allocation of a nation's limited resources to the unlimited wants and desires of its citizens, carries with it the fundamental implication that various uses of our national wealth are alternatives, and that choices must be made, balances struck.

In the early years of this country's development, Americans pushed westward pursuing a "manifest destiny" to determine the course of resource development from coast to coast. This expansion, unlimited as it was in those formative years by the consideration of land scarcity, was marked by wholesale rape of the environment. More recently, reflecting the memory of depression and recession, and in part responsive to continually increasing demands on our tax dollar, municipalities and counties have at times pursued the policy of attracting industry at all costs. Certainly, the creation of hundreds of jobs and broadening of the local tax base to satisfy, for example, accelerating demands for more and better schools, offer attractive inducements. Yet at the same time, there is an increasing recognition of the fact that choices must be made in the management of our natural resources, and that prostitution and destruction of our natural environment is not a necessary cost of doing industrial business. We are reminded that inducing industry into a given locality, while of great potential benefit to the regional economy, without at the same time establishing adequate standards of control, can set in motion forces causing irreparable damage.

It has long been recognized that wholesale distribution of pollutants into our waterways, while the most economical method of disbursing waste products, is not a desirable thing. Reflecting this consideration, Federal Pollution control standards were established and state agencies created to administer regulation. Too often, however, our activity in the area of resource control must be characterized as a reaction to crisis instead of anticipation of cause. Experience with after-the-fact water pollution has forced these realizations:

1. The initial allowance to polluters of unrestricted use of our waterways is presently destructive;
2. The present status of the art of water cleanup is not totally satisfactory, so that "mopping up" of injury once allowed can only slowly be accomplished;
3. In some instances, because of our inability to cope with the problem in an after-the-fact manner, present inconvience becomes long range irreparable detriment;
4. The process of correcting mistakes once made can prove extremely costly, so that the economies of last year are the burdensome economic and social costs of the next generation.

The result has been, to some extent, and must necessarily be, a shift in emphasis in all our programs to one of prevention. And, underscoring all of this development, is the fact that as the decision-making process becomes more important, the matrix of agencies and organizations involved in the process becomes more complicated. At the federal level, the Federal Water Pollution Control Act and Clean Water Restoration Act of 1966, the authority for this estuarine study, represent steps in the right direction. Private foundations, universities, and numerous governmental agencies are engaged in enumerable research projects and the issuance of suggested proposals. At the state leval, Pollution Control Boards, Planning and Community Affairs Agencies, and State Game Departments engage in studies and promulgate regulations. Additionally, the role of the individual citizen and property owner becomes of increasing importance as Americans become more politically aware. But the dedicated activities of all these agencies, organizations, and individuals can be reduced to impotency by imprudent exercise of the zoning power retained at the local level.

[Given that industry is desirable for overall development of an economic community, there remains the problem of deciding which particular site in the locale is most appropriate for development. The problem is, of course, one of balancing the conflicting interests, a value judgment not particularly suited for determination by a local zoning board. Local officials are continually under the political pressures of the majority of constituants, whose property interests will not be directly affected by industry's location. Confronted with the obvious desirability, on the one hand, of locating industry somewhere in the district, local authorities seldom find insulation from the pressures of immediate economic advantage. At the same time, zoning authorities usually lack the broader perspective required to give weight to the counterveiling interest, a perspective which can only result from a specialized working knowledge of the technological considerations involved. Understanding the enormous complexities created by the interaction of fresh and salt waters in the estuarine situation requires the specialized activity of a group concerned only with this narrow problem.

Yet, at the same time that a broad perspective is required, the problems presented by the selection of one particular site or another are very much individual. The selection of a site for industry's location must be made on the basis of an evaluation of the peculiar problems of individual water conditions. In particular, the satisfactory presence of existing oil refinery sites at Ferndale and March's Point is of little precendential worth in evaluating the merits of location of similar operations in the Port Susan area. The Ferndale site, enclosed on three sides, and the March's Point site, near a rapid current exchange, offer relatively free circulation. On the other hand, Port Susan is at the end of an arm where there is very reduced tidal exchange. There are frequent occasions where the water in Port Susan undergoes little replacement or interchange with surrounding waters. Strong southern winds often blow right into Stanwood. Refineries at best should be by open water, not on a "deadend" bay where the tide flow is confined and where beaches can be so easily ruined.

Certainly open water conditions do not present the same problems as are encountered in estuarine areas, and recognition of this crucial distinction can only be disclosed upon careful analysis of the particular situation.

Of critical importance in determining the particular location of the industry is the recognition that spillage and possible consequent pollution can result more often from inevitable accidents than from the conscious design to retain substandard operations. Pollution due to accidents may result from pipeline ruptures, vessel groundings, or from human failure in transfer operations. The growing number of major spills from marine cargo operations is a present fact. The presence of water pollutants may effect the health of the entire community, as well as necessarily cause extensive property damage to beaches and determine the lives of marine inhabitants. Coupled with the inevitability of accident, and the serious consequences to marine life and property interests, is the present inadequecy of the after-the-fact "mopping-up" approach to solving the problem. Although these techniques are improving, they are presently inadequate when emergencies do occur. Consequently, it is of primary importance that the site of such a potentially dangerous land use *not* be located in an area characterized by weak tidal currents, slow interchange with surrounding water, southerly winds which hold surface water in the area, and bottom water which mixes and moves even more slowly. The initial location decision must, because of the present state of the art of "mopping-up," be relied upon to mitigate the damaging effects of the inevitable accident.

In short, the situation dictates a preventative approach. Environment-affecting decisions must be more carefully and intelligently made. Choosing between available alternative land uses requires the development of long range policies geared to balancing all conflicting interests. In addition to long range planning and formulation of general policies, intensive studies of particular estuarine areas must be undertaken to disclose individual problems created in various tide flow situations. To minimize the damage done by the inevitable accident, zoning authorities must not proceed until the results of adequate in-depth studies are available for their careful examination. Only in this way, by initially locating industry where its damaging affects can be minimized by the natural flushing operation of the environment itself, can we be assured that our estuarine areas will be protected, so that destruction of our recreational facilities need not be the price paid for industrial development.

WASHINGTON STATE ASSOCIATION OF COUNTY PARK BOARDS AND DEPARTMENTS.

Ann H. Wolford, President
W.S.A.C.P.B.D.

TO: **UNTED STATES DEPARTMENT OF THE INTERIOR**
MR. JOHN VLASTELICIA, REGIONAL COORDINATOR
NATIONAL ESTUARINE POLLUTION STUDY
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
570 PITTOCK BLOCK
PORTLAND, OREGON 97205

The estuarine areas of the State of Washington and of Puget Sound are world renounded. Are we going to let pollutants spoil all this? We of the 'Washington State Association of County Park Boards and Departments surely hope not.

The figures for commercial and pleasure fishing in the Sound, and along our coastal area run into the millions of dollars for our States economy.

The estuarine area of Puget Sound through which the young fish fry must pass to reach the ocean, must be kept in their natural state to furnish them necessary food on their way.

The well-known "Olympia" oyster is only grown in these estuarine areas as are the Dungeness crabs.

All of Puget Sound is a "flyway" for migratory water fowl and the ocean beaches offer much in the way of commercial and sports salmon fishing; smelt raking; and clam digging. Just the ability to swim, wade or beachcomb along the ocean beaches offers so much to the well being of those thousands of our citizens who do this every year.

Pollutants from canneries, laundries, slaughter houses, and milk processing plants now dump into our rivers and thus to the ocean and bays. The increase of motor boats dumping their sewage and garbage into our waters must be stopped, for the sake of beauty and the health or our citizens.

Estuarine areas once disturbed can never be replaced since these are formed in a very special way by nature and mans substitutes have never proved successful.

We, in the State of Washington, where sailing, motor boating, swimming, clam digging, hunting and fishing plus the many other advantages gained through our estuarine area such as our climate and fertile crops do not wish to find ourselves in the same situation as the more populace area where we would have to try and re-create that which we had spoiled through poor planning.

Estuarine controls MUST be put into effect NOW and these should be State or Government since in a small area, individual desires and the lure of the "almighty dollar" might tend to destroy something which might have a very definate impact on the whole area.

Ann H Wolford
Ann H. Wolford, President
Washington State Association of County Park Boards and Departments.

AHW:ms
cc: Mr. Ole Eide,
State of Washington: Dept.of Game

SKAGIT COUNTY PARK & RECREATION BOARD
Room 306 Skagit County Courthouse
MOUNT VERNON, WASHINGTON 98273

MMISSIONERS:
JAMES HAMMACK
OTTO GREENSTREET
W. ED. CLARK
HARRY OSBORNE
DR. JACK PAPRITZ

LANCHE CROW, SEC.
ANN H. WOLFORD, CHAIRMAN
PHONES: 336-5366 OR 336-3366

Re: Skagit County, Washington
Estuarine Areas

July 22, 1968

The Skagit County Park Commission is vitally concerned about the ever increasing pollution of our estuarian area within our borders.

Skagit County Western portion comprises three main bays; Skagit Bay into which the Skagit River flows; Samish Bay into which the Samish River flows; and between these two is Padilla Bay into which a number of sloughs flow. All three of these bays are important for their economic and recreational value.

The growth of industry, with it's consequent influx of people creates an ever growing problem. The rapid increase in pollution is therefore a real threat to the estuarine areas of Skagit County.

The whole ecological basis of the Western portion of our County is endangered. This is particularly true of Padilla Bay where refineries and pulp mills are already employing waste and the proposed industrial and housing developments would bring about the loss of the entire Bay.

Following are some statistics compiled from government and state records:

VALUE OF THE BAYS:

1. These are important feeding grounds for Black Brant. Padilla Bay has one of the finest beds of eel grass (on which Brant feed) in the United States. State records show that over 67% of all Brant in the area feed here.

2. It is a "flyway" for migratory water fowl. A nine year count for dabbling ducks using the Bay was 56,910 per year. The Whistler Swans feed here.

3. It is a natural rearing pond for Salmon Fry which come down the Skagit River - - through Swinomish Channel to feed and grow in the Bay before continuing on to the ocean.

4. Larch catches of crab, herring, and smelt are taken each year; both commercial and sports fishing. In 1963, over 68,357 pounds of smelt were taken commercially and no one could count the "sports take" when the smelt were running. In 1965, 106,901 crabs were taken. This does not include the pleasure gained nor the poundage taken by families for their own enjoyment and food.

5. Hundreds of people use these waters for sailing, motor boating, water skiing, and bathing and many just wade in the pools, or along the shores studying nature and watching the blue heron fishing and the bald eagles soring above them.

6. The equible climate of the area is definately effected by these bodies of water and tend to make the Skagit Valley one of the richest valleys around the State of Washington, since a great portion of all the berries, peas, corn, broccoli, and cauliflower in the United States of America are canned or frozen in this valley.

7. Beauty can have no price tag and the beauty of these bays with the panoramic view of the San Juan Islands and the breath taking sunsets can never be replaced once they are spoiled with smoke stacks and air pollutants.

Since the Army Engineers are only interested in the navigable phase of the water, the protection from pollution of said waters must be done by the people. By the people we mean the State and National government.

Too often, local personal desire for the "almighty dollar" out weigh any constructive thinking in an area where overall preservation should be done.

Legislation on 'Water Pollution Control" must be set up and enforced. This needs to be done in the immediate future or these estuarine areas will be lost forever. Once they have been disturbed, they can never be returned nor will the birds or fish return in mass to a rebuilt area.

Ann H. Wolford

Ann H. Wolford, Chairman
Skagit County Park & Recreation Commission

AHW:ms
7/22/'68 Mr. John Vlastelicia, Regional Coordinator
To: United States Department of The Interior,
National Estuarine Pollution Study
Federal Water Pollution Control Administration
570 Pittock Block,
Portland, Oregon 97205

cc: Mr. Ole Eide, State of Washington
Department of Game
1100 East College Way,
Mount Vernon, Washington 98273

Whatcom County
Soil and Water Conservation District

Phone 734-5454, Ext. 486 • P. O. Box 1056
Room 350, Post Office Building • Bellingham, Washington

July 22, 1968

The Whatcom County Soil and Water Conservation District wishes to go on record as supporting a National Estuarine Pollution Study.

It is hoped that the study will consider the source of such pollutants as sediment and support a program aimed at keeping erosion in check.

Water quality, land and shoreline management will require a joint operations of community and agency authority.

Gerald Digerness
Chairman
WCSWCD

SUBMITTED BY: Professor Francis G. Bartlett
General Engineering Department
University of Washington

The basic conflict between public interest in "the good life" as provided by access to the shoreline, and industrial utilization of the same areas, could be alleviated by establishing usable standards that hopefully would be reasonably acceptable to the disputants in resolving their differences, that could be based on the following items:

A. A method of classifying shoreline areas on the basis of their natural characteristics--the hydrography; bathymetry; geology; cable areas and underwater archeological sites; as well as the associated water features such as tides, currents, exposure to winds, and the marine life.

B. Associating the characteristics on the water side of the interface with the land features--the topography; vegetation; geology; transportation facilities such as rail, truck, conveyors and pipe lines; availability of power; structures; parking areas; sites of unique and outstanding esthetic value.

C. A method of classifying potential user characteristics such as the volume or weight of materials crossing a given length of shoreline per unit of time, the space and operational costs of the handling equipment, the potential concentrations of the public seeking enjoyment, validation of the need for shoreline sites versus more remote locations for transfer, storage and processing facilities, and the willingness of enterprises to provide limited public access to shore-side faclities kept in a pleasing condition.

Whatcom County
Soil and Water Conservation District

Phone 734-5454, Ext. 486 • P. O. Box 1056
Room 350, Post Office Building • Bellingham, Washington

July 22, 1968

The Whatcom County Soil and Water Conservation District wishes to go on record as supporting a National Estuarine Pollution Study.

It is hoped that the study will consider the source of such pollutants as sediment and support a program aimed at keeping erosion in check.

Water quality, land and shoreline management will require a joint operations of community and agency authority.

Gerald Digerness

Gerald Digerness
Chairman
WCSWCD

SUBMITTED BY: Professor Francis G. Bartlett
General Engineering Department
University of Washington

The basic conflict between public interest in "the good life" as provided by access to the shoreline, and industrial utilization of the same areas, could be alleviated by establishing usable standards that hopefully would be reasonably acceptable to the disputants in resolving their differences, that could be based on the following items:

A. A method of classifying shoreline areas on the basis of their natural characteristics--the hydrography; bathymetry; geology; cable areas and underwater archeological sites; as well as the associated water features such as tides, currents, exposure to winds, and the marine life.

B. Associating the characteristics on the water side of the interface with the land features--the topography; vegetation; geology; transportation facilities such as rail, truck, conveyors and pipe lines; availability of power; structures; parking areas; sites of unique and outstanding esthetic value.

C. A method of classifying potential user characteristics such as the volume or weight of materials crossing a given length of shoreline per unit of time, the space and operational costs of the handling equipment, the potential concentrations of the public seeking enjoyment, validation of the need for shoreline sites versus more remote locations for transfer, storage and processing facilities, and the willingness of enterprises to provide limited public access to shore-side faclities kept in a pleasing condition.

APPENDICES

PAGE
A. List of Speakers at Seattle, Washington . . . 117

B. List of Attendees, Seattle, Washington 118

APPENDIX A

Name	Address
Speakers	
John J. O'Connell	Attorney General, Temple of Justice, Olympia, Washington. 98501.
Marvin Durning	1411 4th Avenue Bldg., Seattle, Washington. 98104.
C. S. Zickefoose	Washington Environmental Council, 1045 So. 154th, Seattle, Washington. 98148.
Francis G. Bartlett	University of Washington, 211 General Engineering Bldg., Seattle, Wash. 98105.
Mrs. Denton Sherry	SAVE PORT SUSAN COMMITTEE, Rt.#1, Box 337-Stanwood, Washington.
Arthur H. Yoshioka	Port of Seattle, P.O. Box 1209, Seattle, Washington. 98111.
Wayne Bishop	Seattle City Light, 1015 Third Ave., Seattle, Washington. 98101.
Bob O. Bower	Oyster Institute of North America, Rt.#14, Box 123, Olympia, Washington. 98501.
Max Katz, Dr.	Washington State Sportsmen's Council, College of Fisheries, U. of Washington, Seattle, Washington. 98103.
John E. Ward	P.U.D. #1 of Snohomish Co. and R.W. Beck & Assoc. 200 Tower Bldg., Seattle, Washington. 98101
Harry R. Fulton	Director of Planning, Whatcom County Regional Planning Council, Whatcom County Courthouse Bellingham, Washington. 98225.
Conrad Hougen	Wash. Assn. of Conservation Dist., Rt #2, Everson, Washington. 98247.
C. S. Sargent	Ass'n of Washington Industries, 1414 So. Cherry St., Olympia, Washington. 98501.

APPENDIX B

Name	Address
Attendees	
Richard C. Abrams	Scott Paper Company, Everett, Washington. 98201.
Ernest E. Allen	Bureau of Outdoor Recreation, Dept of the Interior, 407 U.S. Courthouse, Seattle, Wash. 98105.
Jack D. Ayerst	Wash. Dept. of Game, 600 No. Capitol Way Olympia, Wash. 98501.
Clemens H. Barnes	SAVE PORT SUSAN - Counsel, 1700 Norton Bldg., Seattle, Washington. 98104.
Roderick A. Barr	Hydronautics, Inc., Pindell School Rd., Laurel, Maryland. 20851.
James P. Behlke	Wash. St. Water poll. Contr. Comm., P.O. 829, Olympia, Washington. 98501.
Milo C. Bell	Water Research Center, 211 Fisheries Center, Seattle, Washington. 98104.
Donald J. Benson	N.W. Pulp Paper Assn., 2633 Eastlake Ave. 2633 Eastlake Ave., E. Seattle, Wash. 98102.
George O. Black	Bureau of Commercial Fisheries, Box 4332, Portland, Oregon.
Duane Blunt	State Water Pollution Contr. Comm., P.O.Box 829, Olympia, Washington. 98501.
Chris J. Boehm	State Sportsmen's Council, 626 Vista Drive, Tacoma, Washington. 98465.
David Boerner	Office of Attorney General, 1311 Dexter Horton Bldg., Seattle, Washington. 98104.
Robert L. Borovicka	Bureau of Land Management, Portland Service Center, 710 N.E. Holladay St., Portland, Oregon. 97232.
John Bronow	Room 431, County City Bldg., Tacoma, Washington. 98402.
Fred L. Burr	King Co. Sportsmen's Council, 2731-50th Ave. S.W. Seattle, Washington. 98116.

Name	Address
Attendees	
Robert J. Castelli	Ideal Cement Co., 5400 W. Marginal Way S.W., Seattle, Washington. 98134.
Dave Checcarelli	State Representative, 3823-42nd S.W., Seattle, Washington. 98116.
Howard D. Copp	Washington State University, Albrook Hydraulic Lab., Pullman, Washington. 99163.
James L. Costa	Int. Longshoremen & Warehousemen's Union, 417 West Newell St., Seattle, Washington. 98119.
James A. Crutchfield	U. of Wash., Dept. of Economics, Seattle, Washington. 98105.
David Dapkus	Bur. of Outdoor Recreation, U.S. Courthouse, Seattle, Washington. 98104.
Roger A. DeCamp	National Canners Assn., 1600 S. Jackson St., Seattle, Washington. 98104.
John O. Denison	Rayonier ITT, Olympic Research Division, Shelton, Washington. 98108.
R.V. (Vern) Divers	State Dept. of Agriculture, P.O. Box 128, Olympia, Washington. 98501.
Joe Dwyer	Dept. of Interior, Portland, Oregon. 97205.
George J. Eicher	Portland General Elec. Co., 621 S.W. Alder, Portland, Oregon. 97205.
W.P. Estby	The Nakat Packing Corp. P.O. Box 69, Anacortes, Washington. 98221.
Griffith C. Evans, Jr. (Capt.)	Oceanographic Comm. of Wash., c/o Pacific Science Center, 200 2nd Ave. N., Seattle, Washington. 98109.
W. J. Finnegan	Puget Sound Power & Light Co., Puget Power Bldg., Bellevue, Washington. 98004.
Bruce F. Forbes	King County Flood Control, Rm. 400 Courthouse, Seattle, Washington. 98104.

Name	Address
Attendees	
Gerald Friske	Texaco, Inc., P.O. Box 622, Anacortes, Washington. 98221.
M. Edward Garling	St. of Washington Dept. of Water Resources, 335 General Admin. Bldg., Olympia, Washington. 98501.
Arthur R. Gerlach	Corps of Engineers, 1519 Alaskan Way S., Seattle, Washington. 98101.
John R. Glassy	Tacoma City Water, P.O. Box 11007, Tacoma, Washington. 98411.
J. L. Haff	Todd Shipyards Corp., 1801-16th Ave. S.W., Seattle, Washington. 98134.
J.A.R. Hamilton	Pacific Power and Light, Public Service Bldg. Portland, Oregon. 97204.
Judd Hammack	Grad. Student Economics, Economics Dept., U. of Washington, Seattle, Wash. 98105.
Geo. H. Hansen	Washington St. Water Poll. Cont. Comm., P.O. Box 829, Olympia, Washington. 98501.
Dwight S. Hawley	State Legis., Ch. Fish. Inter. Comm., 3310 N.W. 80th St., Seattle, Washington. 98107.
E. H. Hendrickson	Interagency Comm. for Outdoor Recr. 114 No. Columbia, Olympia, Wash. 98501.
Ernest Hopp	Washington State U. Extension Service, West. Wash. Research & Exten. Center, Puyallup, Washington. 98371.
J.A. Jaap, U.S.N. (Rear Admiral)	Stanley Associates, 1519 Norton Bldg., Seattle, Washington. 98104.
Timothy Joyner	Bureau of Commercial Fisheries, 2725 Montlake Blvd. E., Seattle, Wash. 98102.
Lloyd P. Kirry	Planning & Commty. Affairs Agy., 1306 Capitol Way, Olympia, Wash. 98501.
Wayne Kite	Skagit Co. Planning Dept., Rm. 311, Co. Courthouse, Mt. Vernon, Washington.
William H. Klein	Bureau of Outdoor Recreation, Room 407, U.S. Courthouse, Seattle, Washington. 98104.

Name	Address
Attendees	
C.B. Lake	Henderson Ind. Corp., 12333-3rd N.E., Seattle, Wash. 98101.
Leif R. Larson	City of Edmonds, Edmonds Civic Center, Washington. 98020.
E.H. LeMier	Wash. Dept. Fish., Rm. 115 Gen. Adm. Bldg. Olympia, Washington. 98501.
Harold E. Liebe	Pierce County, 1046 County-City Bldg., Tacoma, Washington. 98402.
William F. Liening	Seattle-King Co. Health Dept., Rm. 904, Public Safety Bldg., Seattle, Wash. 98104
P. E. Manderscheid	U.S. Bureau of Reclamation, P.O. Box 5200, Spokane, Washington. 99205.
Warren H. Marple	Bonneville Power Adm., P.O. Box 3621, Portland, Oregon. 97208.
John H. McCord	Univ. of Washington, 2200 N.E. 88th., Seattle, Washington. 98105.
R. K. McCormick	Water Pollution Control Comm., 3700 Rainier Ave. S., Seattle, Wash. 98144
Robert L. McNeil	Pac. N.W. River Basins Comm., 110 E. 13th. Vancouver, Wash. 98661.
Ernest A. Moore	Port of Seattle, P.O. Box 1209, Seattle, Washington. 98111.
Bishop Mosether	5231-16th N.E., Seattle, Wash. 98105.
Kent Mountford	Barnegat Thermal Pollution Project, Rutgers University, New Brunswick, N. J.
Alfred T. Neale	State Pollution Control Comm., Box 829, Olympia, Washington. 98501.
Robert F. Neudorfer	N.W. Div. Naval Fac. Engr. Command, 1638 W. Lawton Way, Seattle, Wash. 98119.
W.R. Norton	Water Resources Engineers, 109 W. Harrison St. Seattle, Washington. 98104.
David Nunnallee	Univ. of Wash., 8012-N.W. 28th., Seattle, Washington. 98107.

Name	Address
Attendees	
Jesse M. Orme	Fishermen's Marketing Assoc. of Washington. 3603 Gilman Ave. W., Seattle, Washington, 98199.
Robert W. O'Brien	(Congressman Floyd V. Hicks) 1032 House Office Bldg., Washington, D.C. 20515.
Stephen C. Paine	Seattle-King Co. Health Dept., 904 Public Safety Bldg., Seattle, Washington. 98104.
E.C. Pewters	Wash. St. Canal Commission, 210 E. Union Ave., Olympia, Wash. 98501.
Mark J. Pike	B.O.K., U.S. Courthouse, Seattle, Washington. 98104.
Sam Reed	State Health Dept., Public Health Bldg., Olympia, Washington. 98501.
Charles B. Roe	Asst. Attorney General, Temple of Justice Olympia, Washington. 98501.
Larry A. Roesner	Water Resources Engrs. Inc., 109 W. Harrison, Seattle, Washington. 98119.
George H. Salzer, Mayor	P.O. Box 366, Steilacoom, Washington. 98388.
John C. Serwold	Shoreline Community College, 16010 Greenwood Ave. North, Seattle, Washington. 98103.
Warren E. Shanks	U.S. Fish and Wildlife, Div. Fishery Services, 730 N.E. Pacific, Portland, Oregon. 97213.
Felix E. Smith	Bureau of Sport Fish & Wildlife, Box 3737, Portland, Oregon. 97208.
Wesley R. Spencer	State Soil & Water Cons. Comm., 335 Gen. Adm. Bldg., Olympia, Washington. 98501.
Robert W. Steele	Seattle Marine Lab., Inc., 1403 N.W. 45th, Seattle, Washington. 98105.
Allen W. Summers	U.S. Army Corps of Engineers, 1519 Alaskan Ways, Seattle, Washington. 98134.
P.B. Tack	The Boeing Co., Orgn. 6-6000, M.S. 6E-04, The Boeing Co., Renton, Washington. 98055.

Name	Address
Attendees	
Daniel R. Tangarome	F.W.P.C.A., Portland, Oregon 97205
Jerry N. Uyeda	Lt. JG, U.S. Coast Guard, 618 2nd Ave., Seattle, Washington. 98104.
E.J. Warchol	Bonneville Power Adm., P.O. Box 3621, Portland, Oregon 97208.
Storrs Waterman	Chemical Industry Council, P.O. Box 4102, Portland, Oregon. 97208.
D.G. Watson	Battelle-Northwest, Richland, Washington. 99352.
L. Dennis White	Green River Community College, 12401 320 S.E., Auburn, Wash. 98002.
A.E. Williamson	Mobil Oil Corp., P.O. Box 8, Ferndale, Wash. 98248.

ABERDEEN MEETING

CONTENTS

PART I - ORAL STATEMENTS PRESENTED AT MORCK HOTEL, ABERDEEN, WASHINGTON, JULY 25, 1968.

PAGE

Call to Order by Mr. Herbert C. Clare 133

Opening Remarks and Introduction of Panel 133

Speakers:

Mr. Eric O. Anderson, State Representative 139

Discussion 143

Mr. Bob Bailey, State Senator 145

Mr. J. J. Stein, Representative, Public Utility District, No. 1, of Grays Harbor 146

Mr. L. M. McGinnis, Manager of Grays Harbor Division, ITT Rayonier 148

Discussion 154

Mrs. Carmelita Shackleford, Representative, LANCE (Local Action for Natural Clean Environment), Belfair, Washington . . 159

Discussion 163

Mr. James Connolly, Planning Director, Mason County 165

Discussion 165

Mr. J. O. Julson, Director of Air and Water Resources, Weyerhaeuser Co., Tacoma, Washington 169

Discussion 174

Mr. Lewis R. Holcomb, Executive Secretary, Washington Public Ports Association 182

Discussion 186

Mrs. James Guenther, Representative, League of Women Voters of Washington 197

Discussion 204

Mr. Clarke M. Williams, Chemical Engineer 212

(Continued)

PART I (Cont'd) PAGE

Discussion 214

Closing Remarks 215

Adjournment 217

PART II - Written Statements

Columbia River Fishermen's Protective Union
322 10th Street, Astoria, Oregon. 97103. 221

Bert Cole, Commissioner of Public Lands
Olympia, Washington 222

Washington State Department of Fisheries
Room 115, General Administration Building, Olympia,
Washington. 98501 224

Grays Harbor Soil and Water Conservation District
Room 6, 100 F Building, Montesano, Wash. 227

Grays Harbor Chamber of Commerce
Aberdeen, Washington 228

Lower Columbia River Sportsmen's Council
101 East 38th St., Vancouver, Washington 230

State of Washington Soil and Water Conservation Committee
335 General Administration Bldg., Olympia, Washington.
98501. 234

Thurston County Soil and Water Conservation District
Courthouse Annex, Olympia, Washington. 237

APPENDICES

A. Grays Harbor Water Quality and Its Utilization as a Resource,
ITT Rayonier, Inc. .243

B. Grays Harbor Water Quality and Compatibility of Uses,
ITT Rayonier, Inc. 271

C. Trends in the Chinook, Silver, and Chum Commercial
Fishery in the Gray's Harbor and Willapa Bay Areas.
Max Katz 332

(Continued)

APPENDICES (Cont'd)

D. Trends in the Steelhead Sport Fishery in the State of Washington with Emphasis on the Fishery in Streams of the Puget Sound, Hood Canal and Grays Harbor Areas. Northwest Pulp and Paper Association. 356

E. "Suicide in the Shallows," National Wildlife 401

F. House Bill No. 946, Chapter 139, July, 1967. 408

G. List of Speakers at Aberdeen, Washington. 415

H. List of Attendees at Aberdeen, Washington. 416

INDEX 419

PART I

ORAL STATEMENTS
PRESENTED AT ABERDEEN,
WASHINGTON, JULY 25, 1968.

PROCEEDINGS

MR. CLARE: Ladies and gentlemen, I'm not certain that the microphone is turned on, I'm going to try to get along without the microphone at the panel table today; if at any time you are unable to hear, I would appreciate you to raise your hand and we will try to raise the level of the presentation so that you can.

I am glad to welcome you to this, the second meeting which is being held to consider the impact of pollution on Washington's coastal waters. The first of these meetings was held in Seattle on last Tuesday, July 23. As you know from the announcement you received, these meetings are being conducted as a part of the joint Federal-State input to the National Estuarine Study, the National Estuarine Pollution Study.

My name is Herbert C. Clare. I am representing Mr. R. F. Poston, the Regional Director of the Northwest Region, Federal Water Pollution Control Administration, Department of the Interior.

First I would like to make a few introductory announcements -- after which I will introduce our co-chairman and the panel members. The first announcement is that we are very anxious to have each of you register -- indicating whether you would like to make a statement at this meeting, and whether or not you would like to have a copy of the proceedings. You will note that a report of this meeting is being made by Mr. Robert Gee of the Cascade Reporting Service. This transcript of this meeting will be combined with that of the Seattle meeting which was held on Tuesday, and a copy of the combined proceedings will be available to you on request. Some of you have already indicated on your registration card that you want copies of the proceedings.

If any of you decides later in the meeting that you would like to make a statement without previously having indicated you would like to do so, please contact the young lady at the registration desk and she will bring your card up to us immediately.

Please understand that this is your meeting. Federal and State agencies are being consulted separately and have not been asked to appear here today. This meeting is the opportunity for you and your organization to make your views clearly known regarding present and potential problems in maintaining the quality of Washington's coastal waters as related to land and water uses.

Now I should like to introduce the panel which is before you today. This panel is not here to judge or to cross-examine those of you who make statements. They want to hear from you and to understand what you have to say. Occasionally, members of the panel will ask questions of a speaker to clarify a point or to guide discussions to bring out and to clarify views on an important aspect in the matters you present.

First let me introduce Mr. James Behlke, Director of the Washington Water Pollution Control Commission and Co-chairman of this meeting. Governor Evans has appointed Mr. Behlke as Coordinator for the State of Washington's input to the National Estuarine Pollution Study.

On my right at the far end is Mr. T. A. Wastler, he is from the Federal Water Pollution Control Administration's office of Estuarine Studies at our Headquarters in Washington, D.C. Mr. Wastler's program is responsible for the overall conduct of the National Estuarine Pollution Study.

Next to Mr. Wastler is Mr. Lloyd Kirry, he is Assistant Director of the State of Washington's Planning and Community Affairs Agency.

And next to him is Mr. John Vlastelicia from our Northwest Regional Office staff in Portland, and John is our Regional Coordinator for the National Estuarine Pollution Study.

We are very glad for this good attendance at this meeting, we are glad to see it was necessary to bring in more chairs, and we still have more if we need them. We feel that this is an indication of your recognition of the importance of the meeting and we are looking forward to your contribution to the record on this important matter. All of us here, I am sure, can agree that our estuaries are important and valuable national resources ecologically, economically, socially, and aesthetically, and that the nation has a vital interest in their beneficial uses and their protection or restoration.

Congress recognized the need to protect our estuaries, and in the Clean Waters Restoration Act of 1966, which is an Amendment to the Federal Water Pollution Control Act, it directed the Secretary of the Interior, in cooperation with the many public and private interests concerned, to submit a report to Congress by November 1969. Congress directed that this report should include "recommendations for a comprehensive national program for the preservation, study, use, and development of the estuaries of the nation and the respective responsibilities that should be assumed by Federal, State, local governments, and by public or private interests".

The responsibility for coordinating the study and preparing the response to Congress was assigned to our Agency, the Federal Water Pollution Control Administration. Our approach has been along three lines. First, the estuaries themselves are examined. A description of the national system will be composited in terms of what it is, how it functions, and how it has been damaged by pollution. Next, the social and economic pressures on the estuarine system are being studied. Resource use and the associated economic and social values will be documented to establish the relative importance of these factors to the estuarine system.

These first two phases will provide an estuarine register--a comprehensive inventory--a necessary base for a management plan.

Finally, then on the basis of these studies, recommendations will be prepared for submission to Congress. The recommendations will incorporate the important environmental, social, economic, and political factors, and will be, in essence, a recommended management plan. This plan will describe the estuaries and propose a management system of authorities and responsibilities for their wise use and development.

This ambitious task, of course, cannot be done in any one Federal office. Its success requires that we seek help and advice and the counsel of others. Each Federal agency involved in estuarine work is providing us with program descriptions and comments. Likewise, we are working closely with each coastal State. In this case, we are working with the State of Washington. Through Mr. Behlke's coordination we will obtain a consolidated description of Washington's programs and view relating to estuary management and development. A very important part of our effort is co-sponsorship of today's meeting and to hear what your views are in this regard.

Today's meeting is an opportunity that should not go unheeded. Congress has asked for recommendations before it legislates and it is important that your views be considered.

Now I should like to ask Mr. Behlke to make a statement of this work as far as his agency is concerned.

Mr. James Behlke.

MR. BEHLKE: Members of the panel, ladies and gentlemen, it is my pleasure to be instrumental along with Mr. Kirry for the State of Washington in this timely consideration being given our important estuarine resource. It has become quite apparent that an integrated and unified approach to land use and water quality management is necessary to accommodate the interreacting influences which determine the true values of our estuaries. It is the land and water bonded together where the character of one affects the character of the other. I am sure we all agree that to allow haphazard development is to court disaster. Likewise the plan for one disregarding the other is an invitation to nonsense.

You have assembled here as many interests to add your ideas, desires and plans to development of our harmonic, intelligent approach to our estuarine resource which we all have the right to expect. I am impressed with your response to the meeting invitations and am anxious to hear your statements on this subject at hand.

Thank you.

MR. CLARE: Now we will proceed with the receipt of statements from those of you who are here. Mr. Eric O. Anderson, State Representative, is with us this morning, he has asked that in the interest of other commitments and time that he be permitted to speak first.

Representative Anderson?

ERIC O. ANDERSON

MR. ANDERSON: Members of the Committee and ladies and gentlemen. It is indeed a pleasure for me to be here to testify before this meeting here today and I am going to make a statement first on House Bill 946, which is now law in the State of Washington. Now this bill gives industry a tax rebate and, ladies and gentlemen, we do a lot of talking, but nobody has a solution as far as pollution control is concerned. Pollution control costs millions and millions of dollars and if we are going to be successful we have to give industry a break, and I am going to read you the letter that I wrote to all the senators after you might say, I don't know if I told you that I was the author and the sponsor of House Bill 946 in the last Legislature and that bill is now law in the State of Washington, and I hope our good friend here is doing a good job of it. I might say that there are many applications for these timber companies and everything, I understand there are over 40 applications for tax relief for pollution control right here in the State of Washington, and I'm going to read to you the letter that I received I would say 43 votes out of 48 in the House of Representatives for this most important bill and I might say it was a most important bill as far as industry was concerned that was passed in the last session of the Legislature.

"I believe I share with almost every man and woman in this country a particular fondness for things that are unspoiled. The lakes, the streams and the rivers, the forests and the air are part of our natural heritage. We cannot destroy them or spoil them without incalculable damage to ourselves as human beings.

While I believe that some progress has been made toward improvement of the problems of pollution in America, I also feel that much, much more must be done. In fact, I feel that we must take a fresh look at the entire problem.

Very few people have fully recognized an extremely important factor in the pollution problem. It is above all, a competitive problem.

As a nation, we have encouraged competition, and upon this principle we have built the greatest industrial force in existence. But we must not, as a nation, fail to recognize the fact that certain vital rights must not be sacrificed to retain the competitive integrity of our economy.

The past gives many examples of how industry must on occasion, when the public interest is at stake, modify the natural competitive fabric. It costs a lot of money and decades of squabbling to insure that the best safety equipment would be installed in our plants, on our trains, and elsewhere. Industry gradually accepted the fact that safety had to be looked on as a cost of doing business. The problem was ultimately solved, but it could have been solved better and much faster with a truly cooperative spirit.

It is frightening to see how the competitive structure of our economy has played the devil with pollution. There are now many communities in the nation who scarcely try to disguise the fact that they will wink at pollution violations, that they will require little or no expenditure for this non-productive equipment in order to attract new business. Some companies have been extremely slow to install even minimum controls. Not because theylike polluting--I assure you they don't--but because the cost is so great that it could impair or destroy their ability to compete, to survive. Now, I will read that again--but because the cost is so great that it could impair or destroy their ability to compete or survive. A final part of this dilemma is that our anti-pollution technology has not yet caught up with our processing technology. Much more effort has to be exerted to find adequate ways to prevent pollution.

I don't for one second want my words to be misunderstood. I do not want to see our competitive economy weakened. It is one of our great strengths. What I do want to see is a superstructure--one built from cooperation, leadership, foresight and intelligent legislation, ladies and gentlemen, and I think that's what we need is some intelligent legislation, that will make it possible for American business to remain competitive, yet operate within the strictest standards of the public interest.

I can assure you that tax relief for industry when used for pollution control will see a vast increase in spending for pollution control on the part of industry.

Hand in hand with such a program you would have uniform strict legislation--the same, basically, from state to state, from city to city. It would be patently unfair to encourage the "black market" polluter, be it a city or a company. Only in this way could you assure that the non-polluter company would not be sorely penalized in an effort to be a good citizen."

I might say, ladies and gentlemen, that this has been one of the contentions when I say they leave it up to states where the laws are different, I think they should be the same all over the United States and no non-polluter can go from one state to the other and say well, if you're going to put taxes on me in this state we'll move to some other state, and that has happened.

"I hope you will understand -- the light is not too good for my glasses, I hope you will understand my taking so much time to comment on a problem that we face, but I have a feeling about this country and its industry. I want to see nothing dim its promise of greatness. I am not so naive as to believe we will ever have a utopia, human nature being what it is, but we can have so much that is fine and worth working for--if we are willing to work together with energy, resolution and intelligence."

MR. CLARE: Thank you very much, Mr. Anderson.

MR. ANDERSON: I might say this is a copy here and I scribbled over it -- I changed it a little bit.

MR. CLARE: Thank you, Mr. Anderson, we'll give this to the reporter. There may be some questions, if you would want to see if the panel has any questions, we certainly appreciate your being here and making this statement, it is very helpful and we hope you can stay for most of the session, or as long as you can.

MR. ANDERSON: I feel as far as the panel is concerned I think that is our only solution and the legislators of the State of Washington feel that it is the only solution, otherwise we wouldn't have this law in the State of Washington today and I feel that also it's going to have to be done nationally and that in order to get this thing done we are going to have to do it, and so I hope that when you make your statement, and also I would like for you to have a copy of that bill tacked to my statement, I mean to be used as far as a guideline for your consideration when you make a report to Congress. I would also like a question of the panel, how many states have tax relief for industry?

/Ed. Note: See Appendix F, page 398/

MR. CLARE: I can't speak for the states, as far as the federal government as you well know, it does not have, although Congress has considered this for years, they have never enacted it; does anyone know how many states have this? Mr. Wastler?

MR. WASTLER: I know of three that have some form of tax relief, I just happen to know of them, I haven't checked it out exhaustively.

MR. CLARE: We would be glad to find out and supply you with this information.

MR. ANDERSON: Thank you

MR. CLARE: Mr Behlke, would you see that we have the statute to which Mr. Anderson referred, and a copy of the statute will be reproduced in the proceedings and be made a part of the proceedings.

By the way, I think I should announce, this is a good time to do so, that the record for this meeting will be held open for two weeks, 15 days, during which period we will be glad to receive written statements which you would like to appear or anyone that you know that anyone would like to have appear in the proceedings of these meetings, so if someone couldn't be here today and you would like to make a statement, just have him send it to the Regional Director, Federal Water Pollution Control Administration, 570 Pittock Block, Portland, and we will be glad to have it -- attention of Mr. Vlastelicia -- and it will get to the proper file a little more promptly.

At this time I would like to introduce another State Legislator, probably Mr. Behlke should have done it, State Senator Bob Bailey is here, and we would like to recognize him and see if he has any comments or statement that he would like to make.

Mr. Bailey?

BOB BAILEY

MR. BAILEY: Mr. Chairman, I have no statement to make, but I also represent Congresswoman Julia Butler Hansen and we have no prepared statement, but we wanted to express our interest, and I say this for myself also, to express our interest in the problem of water pollution and also the fact we are very happy to see the state and federal government moving on the same platform in the same direction, but we are concerned about what happens in pollution and we want to hear the testimony today and we want to see your hearing record later.

As Eric pointed out, it is a problem, we don't want to drive industry out, but you don't want to let them continue to pollute the public streams either and we are not so worried about what it is not, but what it could be if something isn't done in the future towards planning in that direction and we could become another Lake Erie or something of that sort, we don't want that to happen, and on behalf of Julia Butler Hansen and myself I would like to thank you for the invitation.

MR. CLARE: Thank you Senator Bailey.

Next we would like to hear from Mr. J. J. Stein, who is here representing the Public Utility District No. 1 of Grays Harbor.

Mr. Stein?

J. J. STEIN

MR. STEIN: Mr. Chairman, gentlemen, ladies and gentlemen, Grays Harbor Public Utility District has the responsibility for the transmission and distribution of electric power to homes and industries in Grays Harbor County.

Forecasts of loads and resources show that large nuclear fueled electric generating plants will be required to meet area power requirements by the middle of 1970. The Commissioners of the Grays Harbor Public Utility District have authorized a preliminary investigation of several potential nuclear power sites along the ocean in Grays Harbor County. Ocean sites are being examined for the reason that the ocean has the capacity to absorb the waste heat with proper diffusion with a minimum of adverse effect. We are much concerned with the pollution of our coastal waters since we recognize that the growth and development of our area depends upon the maintenance of an attractive environment.

We urge, gentlemen, that your Committee consider industrial requirements and the need for jobs in our area as well as the recreational and fishery resources in the development of legislation in connection with the national estuarine policy.

Thank you, gentlemen.

MR. CLARE: Thank you very much, Mr. Stein. Does the panel have any questions?

Thank you.

May I ask that those of you who make statements, if you have an extra copy or a copy that you can give the reporter, it would be helpful, I think, if he had this during your talk.

Next we would like to hear from Mr. L. M. McGinnis of the International Tel and Tel, Rayonier, he is from Hoquiam, Washington.

Mr. McGinnis?

MR. ANDERSON: Mr. Chairman, I'm going to have to go now, is it up to me to get a copy of that bill, or will you get it?

MR. BEHLKE: We will furnish it.

LOWELL MC GINNIS

MR. MC GINNIS: Mr. Chairman, ladies and gentlemen, I am Lowell McGinnis, Manager of the Grays Harbor Division of ITT Rayonier, Incorporated. Our company has been operating a sulfite process pulp mill in Hoquiam, Washington since 1928. During this period, ITT Rayonier has been a major factor in the economy of the area through its pulp mill, associated paper mill and supporting forestry and timber harvesting operations. Today, we employ over 900 persons with an annual payroll of over $8,000,000, place nearly an additional $20,000,000 into the area for purchase of wood, chemicals, supplies and transportation, and provide over 1.1 million dollars in taxes for support of local government.

As a resource dependent industry, ITT Rayonier fully understands and appreciates the significance of conservation. To us, this means both safeguarding and fully utilizing our heritage of water and forests. In this respect, we believe water quality management is a public and industrial responsibility that should have as its objective, the multiple use of water resources. The company endoreses a continuing policy to control and improve air and water quality affected by our operations. In this context, we believe water quality control standards and management practices must give proper recognition to the traditional function of waste assimilation as a legitimate, beneficial, use of water.

Attention to air and water protection factors share equitably with all other factors of our operation. ITT Rayonier operates a marine laboratory at Hoodsport, Washington to evaluate the aquatic environment of all ITT Rayonier mills. The water quality control program at each mill is under a graduate engineer. A major share of ITT Rayonier total research effort is directed towards development of use products from pulping wastes, and for process development leading to practical methods of improving waste control. Since 1960, air and water pollution control and abatement equipment facilities accounted for a major portion of our total capital expenditures in ITT Rayonier's United States manufacturing and research divisions. Approximately 90 per cent of this amount was for water pollution control. The total of capital and operating costs for pollution control and abatement, during the past eight years is over $15,000,000 with more than $10,900,000 of this amount being spent at our Grays Harbor mill. We are currently engaged in discussions with state agencies for major additions to water protection facilities at all of our United States mills. Since the early 1940's we have routinely maintained a thorough program of monitoring the waters of the Grays Harbor estuary.

Grays Harbor is economically one of the most valuable single true estuaries along the north pacific coast. With, around, and from this estuary you will find some of the greatest natural resource development of our outer coast, industry, fishing, shipping, oyster culture, and recreation. We at ITT Rayonier take more than a little pride in our role towards this development. From a small simple pulping operation of some 40 years ago, we have advanced to our present role as a major producer of chemical cellulose pulps marketed throughout the world, fine papers, and silvichemical products derived from what was formerly considered waste materials. We are making progress toward the ultimate goal of maximum utilization of our natural resources with the aid of some of the most modern technology available in our industry, some of which has not yet been duplicated elsewhere.

We recognize that problems have arisen on the estuary in the course of its industrial development. We also recognize that despite our own efforts, and those of others who use the water, that certain questions still remain as to the most beneficial, yet still equitable use of these waters. During the last two years, a great amount of effort and consideration has been given to this matter in the course of setting state water quality standards. We would like to submit, at this time, for the record of this hearing, some of the preceding presentations in the belief that they will be of value in your present considerations.
/Ed. Note: See Appendices A, B, C and D; p. 224 ff./

As a result of our close association with the development of the Grays Harbor area, we have come to realize one of the greatest problems facing society in such an area is the weighing of the social-economic factors of water utilization. There is a basic point of difference between the preservationist philosophy of practically no new use for fear of harm to the environment, and the conservationist philosophy of maximum compatible multiple use. We submit, the conservationist point of view is essential to allow continued development of our resources and employment opportunities. The ITT Rayonier policy of timber management as a continually renewable resource is essential to meet the future needs of cellulosic demands.

We would like to call attention to several specific factors regarding Grays Harbor that bear on your considerations. First, one important use is navigation. The priority of this use must be recognized if the economic interest of the community is to be protected. In 1967, for example, 291 ships and barges called within the Port of Grays Harbor, handling some 371,000 tons of cargo, and taking on approximately 554,000,000 board feet of logs.

Second, the Grays Harbor estuary cannot become a significant source of natural oyster seed, or become an oyster spawning ground. The dynamics and shape of the estuary normally prevent spawning temperatures from occurring. In those rare instances when they do occur, they are rarely sustained for a sufficient period to trigger spawning. If spawning did occur, the flushing rate in the oyster bed areas would carry most of the larvae to sea before they could successfully set.

Third, a comparison of oyster production for Grays Harbor with Willapa Harbor for the period 1935 through 1964 indicates that oyster production for Grays Harbor had increased at an average of 3,000 gallons of oysters per year, while Willapa production had decreased at an average rate of approximately 11,000 gallons per year. Grays Harbor is one of the few areas in the state showing increasing oyster production. These statistics support conclusions that existing industrial discharges and historical water quality have been compatible with the shellfish industry of Grays Harbor.

In summary, we believe this community working together with state agencies has made substantial improvements in the estuary water quality and is continuing to move toward the desired goal of maximum utilization of these waters. Our company is currently discussing future effluent disposal facilities and procedures with the Washington State Pollution Control Commission. We are convinced the State of Washington has all necessary legal and technical requirements to provide for the conservation and development of Grays Harbor. The program of standards setting, and implementation and enforcement, begun under the 1965 Federal Water Quality Control Act, is being effectively applied to these waters. We believe the state is moving forward with all due haste, and it would be imprudent to interrupt, or otherwise interfere with orderly local progress by substitution of authority by another agency or governmental intervention.

We would like to suggest that if any federal interest be considered, it preferably should be in the form of grants to the state for further study of the socio-economic relationships of water use.

In closing, we appreciate the opportunity of appearing before you and respectfully urge that in your final determinations that it include equitable recognition of the many present beneficial uses of the harbor and the demonstrable fact that further water quality improvement is rapidly being made under state agencies.

I thank you.

MR. CLARE: Thank you, Mr. McGinnis. I think there will be some questions. First, I am afraid I misintroduced you improperly, I would like to correct the record if it was an improper introduction, it should have been ITT Rayonier without the interpretation that I gave.

MR. MC GINNIS: ITT Rayonier.

MR. CLARE: You made a reference to preceding statements.

MR. MC GINNIS: These are submitted here.

MR. CLARE: Very well, these will appear as part of the record. Does the panel have any other questions?

MR. KIRRY: You mentioned that the Grays Harbor was not suitable for seeding of oysters, is seeding practical in any other location or I understand that oyster seeds are typically brought in from Spokane and other locations, in other words naturally in this part of the country oysters do not seed themselves commercially?

MR. MC GINNIS: In this harbor this is our contention.

MR. CLARE: Any other questions? Mr. Behlke?

MR. BEHLKE: Towards the end of your remarks you commented about the introduction of other agencies, was this a reference mainly to the given level of government or specifically and definitely a change of agencies or introduction of agencies at say state or federal level?

MR. MC GINNIS: I think our statement may be interpreted, we are completely satisfied with the status quo in the manner in which water quality improvements are being effected, this is, of course, directed to the point that the Pollution Control Commission is in our opinion doing a completely effective job in improving the water quality standards by the establishment and enforcement of the water quality standards.

MR. BEHLKE: I have one other question. Could you define or interpret your statement of social benefits?

MR. MC GINNIS: Social benefits I believe might be reduced to its simplest definition of employment opportunity; we are, as I believe we all know here, a totally timber oriented economy in Grays Harbor and so as timber goes so goes employment opportunities in the harbor.

MR. KIRRY: One other question. You mentioned that further improvements were being considered in terms of water quality control improvements, are these different than the present facilities you have or is there a basic difference or more adequate, or what do you have in mind?

MR. MC GINNIS: Yes, they are different in the sense that they are in addition to what we presently have and it means that the amount and type of discharges which we presently make under our existing waste disposal permit will be further reduced, in specific terms it probably means that we will put in primary treatment to our waste for the removal of celluble type materials, that means a reduction in the amount of biological oxygen demand materials presently being introduced; all of these factors will positively improve the water quality.

MR. VLASTELICIA: I have a question. You mentioned that the role of industry or at least perhaps your interpretation of social benefits here was for industry to provide jobs.

MR. MC GINNIS: Growth.

MR. VLASTELICIA: To grow for the area, and would you see this as a role then of industry in planning now for conservation of our estuarine zones and that the yardstick therefore should be the number of jobs provided?

MR. MC GINNIS: Well, I think these are entirely compatible, in my opinion our timber resource industry can continue to grow in Grays Harbor and perhaps one of the most straightforward illustrations might be another pulp mill or two and at the same time I believe it is entirely compatible with maintaining a quality of water in the harbor that no other beneficial use is harmed. Now, this is where the socio-economic combination join.

MR. CLARE: Any other questions.

MRS. SHACKLEFORD: I have a question. I'm Mrs. Shackleford from Hood Canal, I live near Belfair, Washington. I wanted to ask Mr. Stein if he would explain his waste disposal permit.

MR. MC GINNIS: Mrs. Shackleford, I believe I would be a little remiss if I didn't refer your question to Mr. Behlke, who has the duty and responsibility from his office of issuing these permits, and unless you want me --

MR. BEHLKE: The State of Washington under legislation passed in 1955 has developed an industrial waste discharge permit system where all industries having a liquid or solid waste to be discharged to a water course within the state, irrespective of whether salt water, fresh water, stream, lakes or even underground water, are required to obtain a permit from the State of Washington. They make application for these permits. If there is an increase in waste discharge or in case of a new industry, they must advertise in the local newspapers as to what the characteristic of the effluent will be. The Water Pollution Control Commission reviews the application and then issues a specific permit specifying the conditions under which the industry may discharge an effluent to the receiving waters of the state, and these permits may be of a temporary nature or permanent permit, in any case no permit will be issued for longer than a five year period.

MRS. SHACKLEFORD: Does that affect the water quality in any way?

MR. BEHLKE: This is a tool, basically a tool to improve water quality.

MR. CLARE: For the record, Mrs. Shackleford, I think your question was directed to Mr. McGinnis instead of Mr. Stein.

I would like to remind you that it is not the purpose of this meeting to cross examine those who make statements, we would rather encourage those of you who are here to make your own statements and express your own opinions, and we do this in the interest of time and a clear record.

Incidentally, we are going to have the benefit of a presentation by Mrs. Shackleford in just a moment.

Mr. McGinnis, we thank you very much for your presentation, it will be very helpful in our study.

MR. MCGINNIS: Thank you.

MR. CLARE: Now we should like to hear from

Mrs. Carmelita Shackleford, she's with the organization LANCE, L-A-N-C-E, she will tell you what this means, but I suspect that the last two letters are something about a clean environment and we are very glad to have you here and would like to have your presentation at this time.

Mrs. Shackleford is from Belfair, Washington.

CARMELITA SHACKLEFORD

MRS. SHACKLEFORD: Members of the panel, ladies and gentlemen.

I represent an organization or a group which we call LANCE, that's Local Action for Natural Clean Environment. We are very proud of our clean waters in Hood Canal and we are making every effort possible to keep Hood Canal the cleanest body of salt water in the entire country, inland salt water in the entire country. This LANCE is formed of representatives from other organizations already established in the area. Mrs. Cook, who accompanied me, is from Union and she is the president of the organization, she represents the Hood Canal Improvement Club of Union, I represent Belfair Chamber of Commerce, of which I am a member. I hope I won't bore you with this long statement, I've already sent it in, but I was asked to present it here also.

We have only today received notice of Public Meeting on "Impacts of Pollution on Washington Coastal Waters," and although the deadline for filing a statement with the Department of the Interior is July 16, nevertheless we wish to go on the record with the following statement.

In the name of progress, many of our natural resources are fast being destroyed, and our group has been formed to safeguard the God-given blessing we have enjoyed in the Hood Canal area of northwest Washington.

The first two questions listed in your "Guidelines for Presentations at Public Hearings," number one question, "What are the values of an estuary and how have they been damaged by pollution and how much," these two questions are answered in the June-July 1968 issue of the National Wildlife Magazine, I have a copy here, maybe some of you have seen it, by Wesley Marx in his article entitled, "Suicide in the Shallows." Quoting from that article, "Estuaries need management as comprehensive as that given to our parks, farmland and forests." /Ed. Note: "Suicide in the Shallows" is reprinted in Appendix E. p. 401/

The third question, "What is the future of Washington's coastal zones?" Much, if not all, of the value of our estuarine areas along the coast and on the shores of our inland salt waters will be obliterated, the same as it has been along the Atlantic and Gulf coasts if definite action is not taken right now to halt destruction by our expanding population and the encroachment of modern civilization.

Question four, "What are the best uses of our estuaries?"

Quoting again from Wesley Marx, "Marsh grass rims this cradle of the sea, called Upper Newport Bay in California. A shallow blue-green sheet of water covers its mud-flat bottom. Within the blue-green water dart thousands of tiny, wriggling forms of life which will grow into the ocean's next generation of fish." A home development will soon cover much of this sea cradle with a blanket of dirt, and thus this vast spawning ground will be no more. This is only one example of what is happening.

Here on Hood Canal, at the present time considered the cleanest inland salt water in the entire country, oysters, clams, crabs, salmon, trout, and many other forms of sea life thrive. Silver smelt come in during the fall months to spawn and lay their eggs along the sandy shores. These are just some of the things that make living on Hood Canal a true treasure. Many bulkheads are now being built along our shores, and tons of sand and gravel are being dumped onto our beaches before the sea-walls are built, only to have the mud and silt wash over the natural oyster and clam beds. Many of our oysters are disappearing and there are many complaints about this. Why is this allowed to go on?

Pleasure craft owners find Hood Canal a haven of beauty, famed for its snow-capped mountains, green forests, and warm water for swimming. Yet, some beaches are not fit for swimming because these same pleasure craft dump their raw sewage and garbage into our clean waters. We who live on the waterfront are not permitted to run our sewage into the Canal, nor to dump our garbage therein, and we wouldn't have it any other way, but why are boat owners allowed this doubtful privilege? One of the main objectives of LANCE is to have state legislation passed to make it mandatory that all pleasure craft with sleeping accommodations have holding tanks installed on board with facilities at marinas to empty these tanks and dump their garbage.

Question number five, "What system of management, local, state and federal, will best provide for conservation and development of Washington's estuarine resources?" In our opinion, a combination of all three agencies, with greater emphasis on local and state.

The writer has personally fought against pollution in Hood Canal for many years. As a member of an organization which initiated a project to keep Hood Canal waters clean, I was chairman of that committee and we were successful in having sewage and garbage disposal ordinances passed for Mason County, where there had been no such ordinances before.

We respectfully submit that you give this statement your earnest consideration, and ask that you cooperate with us in having regulations passed, which we feel needs to be done if the waters of Hood Canal, and other state waters, are to remain free from pollution and able to support the spawning and reproduction of our many forms of sea life.

Thank you very much.

MR. CLARE: Thank you, Mrs. Shackleford. The panel may have some questions, if you please. Mr. Wastler?

MR. WASTLER: I was just wondering; we hear a great deal about the respective responsibilities of state and federal government and I think yours is the first statement that I have heard that comes out quite strongly for a very active local participation. I personally am very happy to hear this, but could you amplify on that a little bit as to maybe what role organizations such as your own can play and should play in management questions.

MRS. SHACKLEFORD: Well, we cooperate fully with the Mason County Health Department and checking up on violations of our ordinance, does that answer your question?

MR. WASTLER: Yes, that's sort of it, a pollution, I guess you could call it a pollution monitoring or watch dog; very fine. Thank you.

MR. CLARE: Mr. Behlke?

MR. BEHKLE: What role do you feel the local government has in control of land development in relationship to this development on the contamination of our waters?

MRS. SHACKLEFORD: In other words do you mean we should allow these bulkheads to go in?

MR. BEHLKE: No, I am asking you what role do you think local government should play in the protection and the consideration of upland use in relationship to its effect on water quality.

MRS. SHACKLEFORD: Well, they do everything they can to keep pollution from the waters, the County Health Department, I'm not sure I just exactly understand your question.

MR. BEHLKE: What about in the role of the County Planning Commission and the approval of plans and this thing, things of this nature where quite frequently the natural vegetation is destroyed and you get siltation as you have explained it, what role do you think that particular local entity has in the preservation of the natural land coverage and the development and control of development of these different plats so land erosion will not affect the water?

MRS. SHACKLEFORD: Well, our county planner is here in the audience, Mr. James Connolly of Shelton, maybe he could answer this.

MR. CONNOLLY: I'm still here. I feel I've had the finger placed on me, so to speak.

MRS. SHACKLEFORD: I think that finishes my statement.

MR. CLARE: Mr. Connolly, would you identify yourself for the record.

JAMES CONNOLLY

MR. CONNOLLY: My name is James Connolly, I'm the Planning Director of Mason County. I believe the question concerns land development, how we control it, we don't have any erosion control as you specifically mentioned. Many of our developments in the county are pretty well cleaned off by the owner prior to his sale to a subsequent subdivider, they are trying to get every penny they can out of the land. In other instances, there are sales made to a developer by some of our timber companies, naturally the sale price is related to the amount of timber on the land so the developer is quite interested in seeing it clean logged, so if this is what you are referring to in erosion --

MR. BEHLKE: I am looking for the function and the area of activity of local government in the land use area where changing of land use may affect the water quality.

MR. CONNOLLY: Well, standards are never as high as you would like them and our health department has to approve these many plats, we don't have any sewage collection system other than the prime sewage system and all plats at this moment is individual septic tanks, we have areas in the county that we don't allow septic tanks, we have some plats that have been divided and subdivided and you can't build on them, a building permit requires approval from the health department for a septic tank. In this manner we do try to control the use of land by people, but you can't always control people with regulations, they do things that you can't really catch up with them sometimes, they are one step ahead of the law; they're not trying to beat it, they're just trying to enjoy themselves.

MR. VLASTELICIA: Is this Mason County we are talking about? Does it have land use zoning now?

MR. CONNOLLY: No, we are in the process of getting this.

MR. VLASTELICIA: Would you see land use zoning as any help in density in conserving an estuarine zone or planning for its uses? Do you hope to use this in setting up your county planning and zoning, will you be considering the development of the estuaries?

MR. CONNOLLY: I am sure that we will, we have taken particular notice throughout all our planning up to this point in the water use, waterfront usage, not always to our best advantage sometimes, but we do have a distinction in land use at this point on waterfront and upland type lots.

MR. CLARE: Any other questions?

MR. WASTLER: I have one. Would it seem to be the reasonable function of say a County Planning Commission to also zone the water areas as well as the land areas?

MR. CONNOLLY: To zone the water areas? Now you mean pure water, no land connected? You're speaking from the water perimeter outward?

MR. WASTLER: Right.

MR. CONNOLLY: That's an interesting facet, I don't know if anyone else has ever considered that, I've never had that question asked me.

MR. CLARE: An example, Mr. Connolly, might be a proposal to build a high rise apartment out over tidewater for example on piling and so forth.

MR. CONNOLLY: Well, this particular question we do have something similar of that nature thought of considered in our county and some of the neighbors do object to this very type of thing and yet this particular unit of which I am referring is going to build within the minus four foot tide line, so part of the time it's within and part of the time it's without this particular perimeter, but are we speaking of dock use, boat parking, this type of thing within the water?

MR. CLARE: I suspect my example wasn't a very good one because it really doesn't have too much to do with water quality.

MR. CONNOLLY: But this is conceivable, let's go beyond the tidal zone then, this is where you are talking, that is not within the county's control too well at this point, that is more federal.

MR. VLASTELICIA: I think right now the Corps of Engineers, the permit application is made to the Corps for any type of obstruction or development and changes that happen.

MR. CONNOLLY: Beyond the mean low or extreme low.

MR. VLASTELICIA: Would you see then, would you recommend at all that a County Planning and Zoning Commission have a part in granting such permits?

MR. CONNOLLY: Well, in essence the counties do today when there is a permit requested of this nature to the Corps of Engineers, they eventually submit the application to the County Commissioners, so if they so desire, they can refer these to the Planning Commission, many of them are referred to me for suggestion, then unless there is strong objection to these primarily because of advertising, they usually get stopped.

MR. CLARE: Any other questions?

Thank you very much; this is very helpful.

Mrs. Shackleford, we want to thank you for your statement. Just think, now, if you had not have gotten up here now we wouldn't have had the lead to Mr. Connolly.

Next we would like to hear from Mr. J. O. Julson, with the Weyerhaeuser Company in Tacoma. Mr. Julson?

J. O. JULSON

MR. JULSON: Mr. Chairman, and members of the panel, and ladies and gentlemen, My name is J. O. Julson, Director of Air and Water Resources for Weyerhaeuser Company in Tacoma. This statement speaks for the company as a whole, not just its Grays Harbor area.

We have examined Section 5(g) of the Federal Water Pollution Control Act, as amended, in order to confine our remarks to the intent of that subsection. We hope our statement will be helpful to you.

This action is timely. It is gratifying to know that specific planning is proceeding on programs necessary to protect these valuable water resources and to enhance, in a balanced manner, their beneficial use.

Weyerhaeuser Company has long had an interest in the best use of estuarine waters, particularly in the states of Washington and Oregon. With this in mind the company has engaged in detailed and costly research studies of the waters of Willipa Harbor and Grays Harbor in the State of Washington. These carry back as far as 1952.

Oyster growth in Willipa Harbor and Grays Harbor had been studied, and a model of Grays Harbor constructed and used to predict pollutional effects from a sulphite pulp mill which was being considered at the time the studies were initiated. This mill was built, and now is operating at Cosmopolis. Current study on oyster growth in Grays Harbor is in cooperation with a large commercial oyster grower.

Weyerhaeuser Company scientific and technical personnel maintain communication with scientists in the public and private sectors, relating to problems concerning estuarine waters. These communications are valuable to all participants in that each thereby increases his sum total of knowledge in this field of endeavor.

This is indicative of the company's continuing interest in this subject.

I would now like to list some specific recommendations.

First, Developing a management plan for each estuary. Estuaries and estuarine waters are valuable natural resources. A most important goal should be to develop a management plan for each estuary which would provide the best return from balanced uses of that estuary.

Each estuary is unique. Each requires specialized study and evaluation.

Every use of each estuary will contribute pollution of some type and with varying degrees of effect. The total impact of pollution can be minimized by application of the states' water quality standards and plans of implementation now in effect.

Second, principal responsibility rests with each state. The primary responsibility for management of estuarine water quality rests with the state concerned. The state would call upon federal services beyond its capability to provide. Examples would be dredging by the Corps of Engineers, civil structure construction in the estuary under the control of the Corps of Engineers, and those examples which arise because of national security and welfare.

An examination of the responsibilities held by the state and by the federal government should reveal the need, if any, of better definition of responsibilities and their division between the two levels of government.

Three. Resolution of relative importance of uses. Resolution of the importance of each use is a most difficult task even when present uses only are considered. This becomes even more complex when consideration is given to potential future levels of use in each use category.

Such resolution will be very time-consuming. However, no plan of estuarine management will be fully worthwhile unless this type of study is done with deliberation.

Fourth, care needed in changing physical features of estuaries. We recommend that changes to the physical features of an estuary be made only after careful thought has been given to any adverse effects that might arise as a result of such changes. Examples would be dredging, relocation of channels, diversion of waters upstream, and construction of highways across estuaries.

Fifth, tidal effect dictates upstream waste control. The flow of water from an estuary is greatly affected by tidal action. Wastes flowing into a moving current are carried away from the point of discharge. However, tidal action can cause a water particle to stay in an estuary, moving upstream and downstream for many days before it finally reaches the open sea.

Since the estuary is the funnel through which a geographic region drains to the sea, it can be expected that residual wastes will pour into that funnel from the entire region.

In any plan of estuarine management it would therefore seem to be important to reduce this residual waste load at all points in the region.

Sixth, important uses of estuarine waters. We consider these uses to be quite important: Watercourse outlet to the sea; harbor for commercial transport; fisheries - commercial and sport, also shellfish and finned fish; industrial activity; recreation - local and tourist; wildlife activity.

We cannot now give a general opinion of the relative importance of any one of these activities for estuarine waters in general. Again, each estuary presents a unique situation, with hydrological, economic, biologic, and chemic factors differing markedly in each case. In the development of plans for specific estuaries, the company would offer specific thoughts on these uses at the appropriate time.

Weyerhaeuser Company's corporate policy pledges the corporation to operate its facilities in such a manner as to avoid damaging other uses and users of air and water. The policy further pledges the company to use all technically and economically feasible methods available to it to comply with applicable regulations on environmental protection.

Protection, however, is not enough. In the past, we in the United States have made relatively little attempt to manage water in the same sense that we manage our agricultural resources, or in the way in which intensive management is beginningto be applied to our forests.

The need for intensive management of the nation's water resource has been slower in obtaining recognition -- but the need is no less pressing. We should already be planning for rational and systematic management of water.

Weyerhaeuser Company urges that we begin to work now toward managing estuaries to obtain a high yield of estuarine values, just as we manage timberlands to achieve a high yield of forest-associated values.

Thank you, gentlemen.

MR. CLARE: Thank you. There probably are some questions, Mr. Julson.

Mr. Wastler, do you have a question?

MR. WASTLER: My favorite question, what do you think the role of industry and perhaps also industry-wide organizations should be in management?

MR. JULSON: I think industry would be very neglectful in its duty to society as a whole if it didn't participate in this. Industry has certain special talents within itself; for example, in the timber growing industry, we have foresters, we have people who are skilled in the ecology of wildlife, insect life, plant life, botany. In the pulp industry we have found it increasingly necessary, starting back a number of years ago, to employ such types of people as biologists, physicists, chemists, engineers, etc. In the timber growing companies, those who have private land holdings, we find people who are skilled in the management of land masses. Here is a pool of talent. I think it would be a tragedy if these people didn't participate and contribute all they can to this. In the State of Washington (this is going on of course, all around the nation) there are studies going on that deal directly with the land uses bordering on salt water. There's one going on now in Puget Sound. Al Neil of your staff, Jim, is the chairman of that. He is drawing on all kinds of talent. They are spending a tremendous amount of time on it. It is going to be a monumental study. I think industry should be helping on it right along.

MR. WASTLER: Do you think as far as management study and developing plans for management plans for each estuary that industry would be in a position, should be in a position to assist the state and federal governments in what kind of technical information is necessary to collect?

MR. JULSON: Yes, indeed I do, particularly the larger industries. They find themselves staffed with the type of people which the state and federal governments need to call upon. Governments have the same types of scientific skills in their organizations, but they don't have anything on which to balance against the commercial and industrial viewpoint. These dialogues are extremely important. We don't have enough of them, really. I've made that statement many, many times. It's tragic when people have opinions or scientific knowledge that they don't exchange these opinions and that knowledge.

MR. CLARE: Mr. Kirry?

MR. KIRRY: Mr. Julson, Mr. McGinnis made the general statement previously that he felt that the existing mechanism of water quality control through the State Pollution Control Commission and the existing legislation and the organizational mechanisms appeared to be adequate at this time, with the exception that he felt that it might be appropriate where there be federal grant money for further research in this field, would you concur with this general statement:

MR. JULSON: Yes, in general, I wholly support Mr. McGinnis' statement in that first of all, we who deal with the state enforcement agencies find them now really able to, shall I say, lay the wood to us who are polluters. I'll say with all credit to those men it's been a very hard role for them up to now to get anyplace. There was no support for an increasing budget in State Legislatures; they now have that support. There is the very forceful effect of the federal air and water pollution legislation which we are noticing now as having significant effect all over the nation. I find this in my work across the land, wherever we have operations. I feel that the water quality standards that Mr. McGinnis referred to are very appropriate. We are going to find them difficult to meet, which is appropriate, as it would be silly to have pollution abatement or natural resource protection programs in effect if all they did was to maintain the status quo. Secretary Udall once made a statement that these things are not set in concrete. I think that's true; we are going to have a lot more people, we are going to have a lot more industry, we are going to have a lot more activity. You can't go near a stretch of water without polluting it in some way or another; you can't even walk on the bank without polluting it in some way or another. We have to look forward to an improving program, a constantly improving program, all the time. This is the way of life with us from now on.

MR. VLASTELICIA: Mr. Julson, you recommend the development of an estuarine management plan for an estuary --

MR. JULSON: Yes.

MR. VLASTELICIA: And you also stress the responsibility rests with the state principally.

MR. JULSON: Yes.

MR. VLASTELICIA: Do you have any ideas as to just how an estuarine management plan for, say the Grays Harbor estuary might best be developed?

MR. JULSON: Since this is a new field, obviously, we then are sort of breaking new ice here. It does seem to me that all levels of government must participate, the federal, the state, the local, the county government, cities, and so forth. They all must participate in this. Along with that, they must solicit from the area involved the talents and thoughts and comments and assistance of of the residents and those who are active in the area. This is a difficult thing to accomplish, but it can be done if it is started and isn't done under the guise of some emergency or crash program. To avoid that is why we recommend that it be started now. I'm sure that the larger industries in the area would be more than willing to help and give their viewpoints and assistance. I am sure that the state government is already working toward that direction. I was very interested in hearing the Planning Commissioner's comments because I can see what problems he has in answer to Jim's question. It is strictly local. It's a difficult question and problem for him to handle. He needs the support of the state government and the people resident therein, but it can be done.

MR. BEHLKE: You commented about the funneling of the upper water shed down all the water, in many cases substantial amounts of waste funneling down through the estuary, taking this load, what do you view as being some of the major problems in the upper water sheds that are contributing to this load on the estuaries?

MR. JULSON: Speaking specifically of this Grays Harbor area, when Gene Hayden did his oyster studies on the harbor and built the model, he went through some very precise long studies on water movements in the harbor. He calculated that a drop of fresh water which entered the harbor proper, or the salt water effect area, would take 40 days for that particle to get finally to the open ocean. It sloshes back and forth. This is the stagnation effect, number one. Secondly, it's incumbent on all who are discharging anything of any kind into the waters above the salt water effect to take care of their pollution load. They will have to, in keeping with the requirement as to standards. As time goes on, what is satisfactory treatment today may be not satisfactory ten years from today. We all have to recognize this. The fish and wildlife uses, those needs are fairly constant, fairly static. Say that a fish needs two parts a million of oxygen, or four and a half parts a million of oxygen. Let's say the fish needs this today. The fish ten years from today are going to need that same amount; they aren't going to be any different. Our problem in a growing area is to adjust our treatments to that. Then, of course, you could run into things such as dam construction. If we find that dams do get built, with their ponds of water which are held and not released, we find that some funny things happen as you know, Jim, behind those dams. You also get some funny things happening below those dams. These are some of the things that we have to take into account when we are managing a total estuary such as this one.

MR. BEHLKE: What about other non-discharge points? You covered this waste situation very adequately. How about the, oh, shall we say, the more nebulous type of water quality effects, siltation, run-off, these type of things?

MR. JULSON: Mr. McGinnis stressed the value of the major industry in the State of Washington in its renewable quality which of course is the growth of trees. Everyone understands that if you strip trees off land you are going to have soil laid bare. Under a heavy wash you're going to have siltation. In a sense you are going to have a liquid siltation something like the atmospheric siltation in the midwest during the 30's when they stripped the land of grasses. The same principle applies. Obviously it behooves us to manage our forest and timber lands in a way that we are not exposing tremendous vast acreages of land, to cut them right down to the ground except on a managed basis. This can be done. In the management of our timber and logging operations, we've held a number of conversations recently with the Fisheries Department of the State. They have had some problems with us in particular. As a result of those conversations we are now working out a satisfactory arrangement with them whereby we conduct our logging operations in a way that will not cause them problems in fisheries. Here is an example of cooperation and planning, management, and recognizing the other fellow's problem, then doing something about it.

MR. CLARE: Mr. Julson, it's my opinion that you made a very valuable contribution to the record. Thank you very much.

MR. JULSON: Thank you.

MR. CLARE: Off the record.

(Discussion held off the record)

MR. CLARE: Back on the record.

We have cards here for two more statements; before we adjourn I am going to ask if there are others who want to make statements. My problem at this time is whether we should take a ten minute break and risk losing some of you, or push on through until we finish. John has told me he doesn't think there is enough coffee for everyone so I'm tempted to push on if there are no objections. Would you like to have a ten minute break? All right, we'll have a ten minute break.

(Recess Taken)

MR. CLARE: Back on the record.

As I indicated, we have two more cards up here, people who indicated they wanted to make statements, and if anyone else wishes, you'll have an opportunity later to come up, but if you want to get your card up to us, the girl will be glad to change your choice of whether or not to make a statement, we will be glad to hear from you and you will have an opportunity.

Next we will hear from Lewis R. Holcomb, with the Washington Public Ports Association. I am almost compelled to introduce him as Lew Holcomb, I consider him as my private consultant of where and when to fish. Lew, glad to hear from you.

LEWIS R. HOLCOMB

MR. HOLCOMB: Thank you, Mr. Clare, gentlemen of the panel, ladies and gentlemen. Off the record for just a moment, this is establishing somewhat of a first as far as I'm concerned, this is the first time I've been on this side relative to a water pollution control meeting; many a time I've been on the other side listening to presentations from people.

On the record, I do represent the Washington Public Ports Association, which is a state chartered agency, you might say, not necessarily an agency, but an organization which was created by Chapter 31 Laws of 61, and our purpose is to be generally a spokesman for the attitudes and common problems of the ports of the State of Washington. We have currently 41 members, not all of them on estuaries, not all of them on tidewaters, and not all of them are affected or may be affected by the decisions which are made today, but certainly everyone will be very, very interested.

The estuarial areas of this state of ours have a great deal of importance which goes even beyond that which might be apparent, because on these estuaries has essentially been the growth of the State of Washington and the population centers and the industrial areas. We of the Public Ports Association frankly have found them to be our home, so to speak, that's a transfer point between land and water transportation where industry has thrived and where ports have done their part to help in the growth of the state and the nation.

Addressing myself to the questions which the panel would like to hear some comment on, one of the questions that seems to be more important in the view of the panel because it's been asked of others, is what system of management, local, state and federal, will provide for conservation and development of Washington's estuarial resources. Well, I don't think you can separate them. We do feel at this point, however, that relatively effective guidelines have been established already for the protection of the water quality of Washington's coast. The State of Washington adopted water quality standards, the federal government approved them, these standards provide tools for measuring, monitoring and enforcing pollution control and maintaining water quality. The Ports of the State of Washington have in the past and will continue to cooperate with all agencies relative to water quality, industrial development and economic development within a port or regional area. As a matter of fact, we've got to take a look at this thing rather candidly. The need for additional development both in estuarial areas and others should be quite obvious. We've heard lots of talk about population explosions and so forth, but they will continue, planning is already being carried out by state and federal and other agencies to try to give us some idea, guesstimations of what may happen in the year 2020, 2080 and so forth, and it's obvious that the growth of population is going to be such that we are going to have to have a great deal more of all of those elements that supports our population and one of the essential matters we think in dealing with estuaries or other areas and with the government entities who may regulate and manage those areas, is that all such matters relating to development should be viewed from a positive point of view, that is they should consult with each other to find out how we may accomplish something rather than go into a meeting to find out why we should not accomplish it. A positive point of view toward the development of those things necessary for our own human survival is going to be necessary in the future. The status quo, well, there certainly is no such thing from this point on; this is not a static environment or civilization, it's rather dynamic and man needs both occupation and recreation to maintain the health of both mind and body. Now that's why we think consideration should be and must be given to each; in the development of the report which is going to be the result of this meeting we urge your consideration and your attention to be directed toward the fact that while none of us here originally coined the phrase multiple use, we almost live by it. Not every estuarial area should be oriented to industry and not every estuarial area can be preserved for either conservation or aesthetic concepts, that's obvious; in some areas both can be rather compatibly maintained, but when conflicts do arise, they should be solved at a local and a state level under guidelines which have been established after serious participation by all governmental levels, at local, state and federal levels. In some cases we might give consideration to the need for a super-governmental agency at a local level to make judgments for example, perhaps like a regional planning council, they could be or take the role of an arbitrator when impassable conflicts exist and impassable conflicts do arise. Such a group may at this time by some people here be assumed to be in existence on an ad hoc basis when official but rather informal meetings are arranged following application for industrial estuarial harbor improvements and so on, but it's generally been found that in those cases the superior governmental entity envariably pre-empts the decision and if a conflict occurs from the decision to the application, quite often the contrary decision is not taken back to the local area for satisfaction at a local level.

I would like to reiterate that the ports in the past have cooperated, they will continue to cooperate and I do feel that the port districts of the State of Washington do have and should have and should continue to have a very effective and energetic voice in management decisions relative to our estuarial lands.

Thank you.

MR. CLARE: Thank you, Mr. Holcomb. Any questions, panel?

MR. KIRRY: I might ask the question if you feel the standards of quality might be varied from one estuarial area to another based upon its purpose or function or did you mean that there should be a single standard? I missed that point.

MR. HOLCOMB: I don't think I attempted to make that point, however I will say this, that in the establishment of water quality standards there are certain constants which must be maintained, perhaps throughout an entire region or throughout an entire area, but however it is quite logical to assume that after study and if studies so prove that there may be a variation in a standard from -- a certain standard from one estuary to another and I will not say that that will be an intolerable situation, but basically there are certain constants that must be maintained.

MR. VLASTELICIA: Mr. Chairman, I have a question.

MR. CLARE: Mr. Vlastelicia.

MR. VLASTELICIA: You mentioned that the ports are very instrumental in developing the commerce and industry of their area, is there any method now by which they are able to give consideration to other uses of their port district for recreational benefits and aesthetic resource of the areas?

MR. HOLCOMB: As a matter of fact, yes, it is allowable within the statutes which have created port districts per se, there have been some very fine examples of that by public ports of the State of Washington, the Port of Grays Harbor quite recently donated to the Washington Parks and Recreation Commission an area of land at Half Moon Bay, Port of Grays Harbor, or in Grays Harbor near Westport, which land will be developed into a very attractive and undoubtedly a very popular park in the future. At Crescent Bar on the Columbia a public port in that region has created a recreation facility. This is within the periphery of the state statutes and is so allowed. I imagine I could continue to cite other examples, but to answer your question, yes; however, the development must have some relationship to the port also. There is a certain amount of flexibility of interpretation, but yet there are certain boundaries which can't be stepped over.

MR. VLASTELICIA: We heard in the Oregon meeting from a port district that told us about a plan of development that they were working on whereby it was a master plan for development of the port and it was to begin with an evaluation of all the uses of the estuary and waterfront within the port district and they were documenting the values in different areas in a regular research plan, a master plan, to develop as to where industry might go and as to what portions might be left untouched, which portions might be used for residences or to work with the County Planning Commission in this regard and with the city, and do you see that as a direction that ports are going to move? Ports I think are a very powerful influence in the development of their part of the property on an estuary, and are they working towards this now, a master plan for each port?

MR. HOLCOMB: In my relatively brief acquaintance with the ports in this association I find them to be one of the most dynamic groups I've ever seen. I would direct your attention to the comprehensive plan of the Port of Vancouver, for example, which I am sure many of you or most of you are familiar. This is the type of a port activity, port concept that I feel within my contacts with the organization, that more and more of the ports are directing their attention to, they are a viable group which is becoming even more articulate on a local and a county level and involving themselves more and more with planning not necessarily within the confines of their own port, but with the region itself and this is a role which I am certain the ports have adopted voluntarily in the respect that they have seen since the statute was passed in 1911 authorizing ports that the effective force which ports can apply to the better development of an area frankly has been a remarkable thing, and I see even a greater direction toward that and toward, as I say, cooperation and participation in management planning on a broader basis than just within port confines.

MR. CLARE: Mr. Behlke?

MR. BEHLKE: Lew, you mentioned the fact that it's a cooperation of all governmental agencies on basically national, state and local levels, I did detect a note that possibly you feel that local government, local concern does not play its role or is not allowed to play its role per se as much as it should be; getting a little more specific along this line, what do you feel that the role of the port in terms of specific control of pollution in our estuaries such as the areas of pleasure boats that the lady representing LANCE mentioned, what about oil spills and things of this nature, you emphasized we should go into this with a positive approach, what positively are the ports in the state doing and thinking about in these areas?

MR. HOLCOMB: It's rather difficult to separate, Jim, a number of points of the question, however number one, ports are at the present time in many cases working definitely and directly toward pollution control activities in their own area and I feel rightly that they should. I would like to at this point defer a portion of this reply, if I might with the permission of the group, to the Secretary of the Washington Public Ports Association, Manager of the Port of Bellingham, Mr. Tom Glenn, who is in the audience and I know that he would have something specific to say directed to this question, if you don't mind, Jim.

MR. BEHLKE: I would like to get at this area, I would like to hear from Tom, there's no question about this and I am somewhat familiar I think with what Tom might be going to express along these lines. I am interested, though in this pleasure boat area, oil spills and things of this nature because normally oil spills, and I think if we would have had the opportunity to listen to the lady representing the League of Women Voters, she would probably have brought this point out, we've discussed it numerous times.

MR. HOLCOMB: The responsibility relative to pleasure boats, let's take that one on first. It is my impression at this point that when either state or federal standards, legislation, rules or regulations are adopted relative to either pleasure boats or commercial vessels and the waste discharges therefrom, that the ports will immediately if it is a portion of their responsibility, and in many cases it must be, the ports will immediately begin to provide the facilities which will be necessary to take care of this; we operate many, many marina, many billions of dollars worth of developments have been provided by public ports for pleasure craft and I know that in each case commissioners and the managers feel a very direct responsibility to take care of that portion of the problem once it is determined who is going to do what to who.

MR. GLENN: Ports don't have police powers, that's the answer to your question.

MR. BEHLKE: How about oil spills, I think this is another area that I believe we are all vitally interested in, what do you foresee as the role of the port in the control of oil spills or possibly the clean up of oil spills? I look at it this way, that almost every ship that enters the waters of the State of Washington ties up at a port facility.

MR. HOLCOMB: That's very true and in many cases as a matter of fact the last few oil spills to which you are referring have occurred in ports of the State of Washington and a couple of them have been quite serious, however as Mr. Glenn pointed out, the ports themselves do not have the police power at this time which both state and federal water quality management agencies do have, now the only powers that the port may be able to exercise in this regard would be advisory, and I don't even know, I would have to ask a port manager to respond to this, if the port did itself assume the responsibility of spending funds on an emergency basis to clean up or assist to clean up or correct an oil spill, would the relative cost thereto be recoverable from the steamship agencies or the steamship owner on a tariff or otherwise basis. Now Mr. Clandson or Mr. Glenn may be able to answer that one, so with that question unresolved, however, the ports have viewed at this time, not generally, but in some cases, specifically the responsibility for an oil spill rests with the discharger in this particular regard, though if guidelines and/or suggestions and/or facilities are prepared or are needed in ports to assist state and federal agencies in cleaning up oil spills, I am certain that this can be provided and will be provided.

MR. BEHLKE: What positively, though, as an entity that is dealing with both U.S. shipping and large amounts of foreign shipping are -- or do you people foresee in terms of the ports participation in this program, are you at this time projecting?

MR. HOLCOMB: We are moving toward discussion of this, I have been talking with a number of people about that, I've had a number of communications with our organization, we have not up to this date that I know of set a specific seminar of ports for example to say what are we going to provide. I received communications just two days ago, for example, from the Corvallis laboratory, FWPCA, in which a gentleman is asking for an inventory of available facilities to work on just such matters on an emergency basis whether it be a Torrey Canyon or Young American, whichever the spill might have occurred from, what are ports going to provide or might provide or what do they have, we are working toward it, but I can say at this point that I have had no dialogue with them relative to the facilities currently provided.

MR. BEHLKE: Do you think this is an appropriate area of dialogue?

MR. HOLCOMB: I do believe so, absolutely, it will be contrary to any of my past personal thinking not to believe so.

MR. BEHLKE: I would like to hear from Tom.

MR. GLENN: May I be heard from here?

MR. BEHLKE: Yes; this is Tom Glenn, Port of Bellinghame.

MR. GLENN: I think the answer to Mr. Behlke's question lies in the fact that the responsibility for this type of activity is with the U.S. Coast Guard, I believe they have had it assigned to them. Of course the Coast Guard and ports work very close together and as Mr. Holcomb indicates, it's a matter of working out the way to do it; equipment, specific standby facilities to handle it, none exist today to my knowledge in Puget Sound.

MR. HOLCOMB: I may go one step further if I might on this same situation and on the same question, correcting my previous statement that I know of no negotiations that have currently been going on, yes, I do, as a matter of fact I do know that there has been at least one public port of Washington, Port of Seattle and the Metro area has contributed very largely to a study that is currently going on cooperatively between the County of King and the City of Seattle, Water Pollution Control Commission, State of Washington, Port of Seattle, and I think one other entity.

MR. BEHLKE: Metro.

MR. HOLCOMB: Metro, that's right, to determine, well, frankly to I suppose design a facility which will separate oil from water and begin to take care of some of the oily waste which ports and others must contend with and city sewers and so forth, they are cooperating to the extent of about a million dollars to connect to the Metro sewers also. Specific to the question of other oil spills and not necessarily to the discharge of oil to a certain disposal area, I know of one private firm which has contacted at least one of our public ports with an idea perhaps to providing for them and for other Washington ports standby facilities in a number of areas complete with equipment located at a port, complete with styrofoam booms, disposal chemicals, et cetera and vast boats located in certain locations. This would be on a private contract basis to the ports. Now the extent of that negotiation or rather the result of that discussion I do not know at the moment, I haven't had a report back on it, but I do know at least one port was interested, I'm not at liberty at this time to say which one, but whether their negotiations are still going on I don't know, whether it might prove too costly for the port to bear I don't know that either, I haven't been involved right inside the negotiations, but we are discussing it, we're conscious of the problem and I do believe that there are going to be a number of things along this line that we will address ourselves to quite specifically.

MR. BEHLKE: Thank you.

MR. CLARE: Any other questions?

Thank you very much, Mr. Holcomb, you made many helpful points, one that I think is especially important to us is your indication that interest in estuaries goes beyond the local area, actually it goes from local area to national interests and international, because you indicated that shipping from other countries does tie up in these ports.

For your information, Mr. Glenn, I believe that the federal statute pertaining to oil pollution places responsibility in the Federal Water Pollution Control Administration Department of the Interior; this is not to play down the importance of the Coast Guard, because they are the ones that are on the site and make the reports to us and are very, very helpful.

Next we would like to hear from Mrs. James Guenther, the League of Women Voters. We are all familiar with the interest of the League of Women Voters in water pollution control, in fact they wrote a book on it, and I recommend it highly for your reading.

Mrs. Guenther?

MRS. JAMES GUENTHER

MRS. GUENTHER: Off the record, before I begin my prepared statement, on the subject of oil spills I have with me here a copy of a letter to Mrs. Jones of our Water Resources Committee from Mr. Bryan Johnson of the Federal Water Pollution Control Administration regarding a recent oil spill which I think you've been referring to. May I read the letter?

MR. CLARE: May we have the letter in the record?--please, go ahead.

MRS. GUENTHER: Mrs. Jones, the Chairman of our Water Resources Committee, wrote to Bryan Johnson, Director of the Enforcement Program for the Pollution Control Administration, Northwest Region, and just questioned about the oil spills, who was responsible and what was going to be done, and he answered and said:

"On April 10, 1968, (Wednesday), I received a call from the Washington Water Pollution Control Commission informing me that on April 9 Norman Thomas and Dennis McGaughy of the Washington Water Pollution Control Commission had seen oil flowing from the Maxim ship into the waters of Budd Inlet. Immediately prior to this, they had been investigating another oil spill on the west shore of Budd Inlet near Butler Cove. I also was informed that the Coast Guard had been notified and were investigating the spill. The ship's Captain, Mr. C. Y. Chow, was contacted by the Washington Pollution Control Commission and denied responsibility for the oil spill and refused to take cleanup actions.

2. At my request the Assistant Regional Solicitor of the Department of the Interior sent a teletype message to the agent for the Maxim on April 11, 1968, telling them that if they did not clean up their oil, the Federal government would provide for the required cleanup and then bill the Maxim. They again refused to take cleanup action.

3. On April 12, 1968, James Behlke of the Washington Pollution Control Commission was in our office and we discussed the situation with Fred March of the office of the Regional Solicitor. Mr. Behlke supported the previous statements made by his staff regarding their witnessing a discharge of oil from the Maxim. Based on his information, a second teletype was sent to the Maxim asking for cleanup. Since now it appeared that cleanup would have to be done by the Federal Water Pollution Control Administration, and the Oil Pollution Act of 1924, as revised, would be applied, the U.S. Department of Justice, Admiralty and Shipping Section, was contacted.

4. On April 13, 1968, I received a call from the Washington Pollution Control Commission that a bid of about $2500 had been received to clean up the oil mess caused by the discharge from the Maxim. I then went to Olympia to see what cleanup was required. By this time (four days after the spill) all of the oil had become attached to boats, piling, private beaches, and other structures in the harbor area. The only beneficial cleanup which could be done at this time would be to clean up the 50 to 100 contaminated boats.

While in Olympia, I also interviewed Mr. Thomas and inspected the oil spill out near Butler Cove. The Butler Cove spill was about one mile from the Maxim and occurred before the Maxim came into port. I also estimated that the Maxim spill was about five barrels and the Butler Cove spill about twenty barrels.

5. On April 14, 1968, I called Mr. Biglane at Headquarters in Washington, D.C. and gave him the above information. He informed me that we could expend money only to clean up navigable waters and adjacent public beaches. Therefore, all plans for cleanup on our part were dropped.

Our laboratory only recently completed the analysis of the samples collected in this case. These analysis verified that the oil on the beach near Butler Cove did not come from the two vessels then in port. However, the oil collected from the water in the area of the port docks was found to be identical to the oil on board the Maxim. This information has been transmitted to the Regional Solicitor of the Department of the Interior and it appears that a fine will be assessed against the Maxim.

Sincerely yours, Bryan M. Johnson, Acting Director."

It's sort of a self explanatory that they are so busy finding who did it that in the meantime nobody is cleaning it up. We need some kind of method for getting things cleaned up while we're hunting for the --

MR. CLARE: We have no objection for this going into the record.

MR. BEHLKE: No, we would like to see this in the record for the simple reason that we are considering legislation along these lines and to accomplish this which you are interested in is immediate cleanup of the oil spill as well as finding out who did it, we think this is a necessary thing. The only mechanism we have to get an oil spill cleaned up at this time is to dip into our own budget, which is fairly sparse and with no definite opportunity of recovery, so we haven't as yet used this mechanism.

MR. CLARE: I might point out that there are many who think that the federal statute on oil pollution control should be strengthened also.

MRS. GUENTHER: The League is here today because of our belief that long range planning is necessary for the conservation and development of water resources and the improvement of water quality.

Estuarine pollution, therefore, is of great concern to us. The tidelands which appear to most people as desolate wastes, are extremely important to the ecology of our water resources. Marine scientists have only recently begun to realize that the tideland areas are rich with living matter. They are important as breeding and nursery grounds for fish and habitations for shellfish, as feeding and nesting grounds for migratory birds.

The June, 1967 Atlantic points out that over half of the United States harvest of salt water fish and shellfish is estuarine dependent. Thus tidelands represent the livelihood of about 90,000 American fishermen, a total catch of $250 million in 1965.

Yet in America, and the State of Washington is no exception, we fail to consider the unique values of estuaries and drain, dredge and pollute them.

In the Willapa Harbor area, navigation has caused sediment problems and logs are releasing dissolved oxygen from the water which disturbs the food life balance. Backfilling and draining for recreation development has lowered the water table and decreased the size of the estuary releasing excess fresh water. These two things have damaged the cranberry and shellfish crop.

The condition of Grays Harbor has caused great concern to those working with game fish. Discharges from pulp mill operations have lowered the oxygen level of the water, making it dangerous for the survival of game fish. The State Game Department reports that there are periods when the oxygen level does not meet the state and federal water quality standards.

In the highly industrialized Duwamish area, however, because of the Metro sewage treatment system, the estuarine conditions are improving.

In Everett, the water quality is being seriously affected by logging and pulp mills, endangering the food bed for fin fish.

In order to understand the long term effects of pollution on estuaries, a more far reaching study of estuaries is needed. We would hope one of the outgrowths of your present study would be a recommendation that national estuarine management zones be established.

Perhaps a Puget Sound estuarine zone would plan its future development to include some estuarine areas to be used for navigation, harbors and industry and others to be preserved for fish and wildlife resources.

Within such zones there should be a mechanism for better intergovernmental coordination.

At the present time, the 3500 acre Nisqually estuary on Puget Sound is under the authority or possible future authority of two port districts, two county governments, the State Game Department, and if dredging takes place, the United States Army Corps of Engineers. Presumably the federally aided Puget Sound and Adjacent Water Study, now in progress, is also concerned. It is safe to assume that all of these groups are not in agreement as to the best use of this estuary which is the only remaining unpolluted river delta on Puget Sound.

Other groups concerned with open space and recreation, groups which do not now have a voice, may also be interested.

Perhaps a council or commission could be formed with representatives from each local unit of government as well as state and federal agencies. Concerned citizens groups should also be represented.

Planning and intergovernmental cooperation are needed now in order to protect the nation's estuaries and preserve their unique values. In addition, we need more far reaching studies of estuaries and their physical, economic and social effect on our society.

And I have a footnote here which I added after I got here because I realized I had forgotten something very important. After a recent study, the League of Women Voters of the United States reached the conclusion that pollution control equipment installed by industries should be a cost of doing business, however because of the emergency nature of the water pollution situation, we believe some financial incentives should be given to industry at this time.

Thank you.

MR. CLARE: Thank you. Are there some questions?

Mr. Kirry?

MR. KIRRY: Yes; it's been brought out at this hearing today, and I would say even stronger at the hearing in Seattle two days ago, that it is unrealistic to think in terms of the waters of our estuaries in themselves, the polluting aspect actually is the interrelationship of the uses of land and the control of those land uses and the waters; do you, and since it is quite well established that the considerations with the water as a common denominator as well as other factors extends quite widely geographically, do you think that the present -- do you think that there should be a regional organization that should be concerned with uses of land and their relationship to water such as a regional governmental organization, do you think that the existing regional governmental organization, their function should be expanded and strengthened to be more operational than it is under the present law?

MRS. GUENTHER: I think this is, in a way, what we said in the testimony here that perhaps certainly the Puget Sound area as an area must be considered as a whole area, I noticed in some of the testimony today people were talking about planning for one area, like planning just for Grays Harbor or planning just for Nisqually or so on, I don't think you can do this, I think we have to plan for the whole state and certainly by region. One of the big problems of governmental agency at this time, the only one I know of for the Puget Sound area that is doing planning is the Puget Sound Governmental Conference and the ports are not even a part of this group and it seems to me that they cannot really adequately plan for the needs of the land and water in Puget Sound area unless there is some kind of body which represents all of the forms of government and the citizens' interest as well.

MR. KIRRY: I might ask the further question then since the present governmental organization you are talking about applies primarily to the planning function, do you think that the regional organization should have stronger management and control functions over the use of land which at this time is exclusively the prerogative and responsibility of cities and counties and regional governmental organizations under the present law have no authority for the control of use of land, do you think that this should be considered?

MRS. GUENTHER: I think we're going to come to the point where the respective roles of the governments are going to change, certain problems are of a regional nature and perhaps a regional governmental body will have to handle those problems, other problems are more of a local nature and would be better handled by a specific local agency; I think we are moving into a different area where responsibilities are probably going to change, but of course one of the major problems there is we will also have to change our thinking about taxing and how we are to finance other bodies of government. It's a very complicated problem and the League has just or is just beginning, the Puget Sound League is just beginning a study of planning problems in Puget Sound so that we have not -- we are just looking into it at this point, we know something is needed, but we have not come up with any specific recommendations at this time.

MR. CLARE: Any further questions? Mr. Behlke?

MR. BEHLKE: One is a matter of clarification, in your statement you mentioned that samples taken by the

Game Department showed that water quality standards were not being met, I think there is possibly a misinterpretation here, the Water Pollution Control Commission has established water quality standards and we have a plan of implementation and we do not at this time pretend to say that all waters through the state meet the standards that have been established; if this were the case, we would not have a plan of implementation telling and instructing people that they must improve facilities, if all waters were of the quality that has been established, then we wouldn't basically have to do anything except prevent further pollution and this first phase of water quality standards we anticipate within this next five year period to have all waters meeting the standard.

MRS. GUENTHER: When is the deadline?

MR. BEHLKE: Within five years. One other question I would have, you mentioned social effect, would you define social effect for us.

MRS. GUENTHER: Well, I think that estuarine areas or bay areas, the Puget Sound area in particular, it serves, as I said, a physical,economic and social effect; the physical effect of course and the physical things that it can provide which in turn aid our economy; the social effect, certainly the area provides recreation, provides beauty, it provides part of our living, people are intimately involved with it, we can't just think of the estuaries as serving only specific kinds of industry, I think we have to think of the involvement with people and what they want. There are migratory birds and their nesting places there, we have to think of all the different needs and the different -- the aesthetic as well as the economic values.

MR. BEHLKE: May I ask one other question. Would you say social effects and social benefits are somewhat interchangeable in definition?

MRS. GUENTHER: I guess so.

MR. BEHLKE: I don't have anything further.

MR. CLARE: Any further questions? Mr. Wastler has a question.

MR. WASTLER: You have addressed yourself to the role of say a regional planning council or super-governmental organizational group --

MRS. GUENTHER: Intergovernmental I think is better than super.

MR. WASTLER: As far as the planning function is concerned, do you have any thoughts regarding the role of such an intergovernmental council in implementation, that is active management of an estuarine area and a monitoring and enforcement of the concepts of the plan?

MRS. GUENTHER: Well, I couldn't give a League position on this, a personal thought I have is that perhaps a regional agency of this nature would have the same effect on local government that regional planning agencies are beginning to have now, federalfunds are not available unless you get together and I am sure that in order to preserve estuaries sometimes there will be a more expensive alternative and the only way it can be used by the people is if they have federal help in preservation; this is just my individual thought, that you have to have sometimes a federal incentive to get people to cooperate.

MR. CLARE: Mr. Behlke has another question.

MR. BEHLKE: What do you feel the League of Women Voters as an organization, what part can they play in this management of our estuaries?

MRS. GUENTHER: Well, as an organization, the League is vitally interested in water resources, we are here today, our members are interest, I'm thinking rather than just as a League of Women Voters all citizens should be involved in having a voice in what happens to the country that they live in and the League of Women Voters has a voice, other groups can have a voice, I think that we have to do more than just go to hearings and testify, I think that the interested citizen should be part of the policy making bodies, that they should perhaps not just be intergovernmental groups, but intergovernmental groups with qualified talented citizens also represented on policy making bodies rather than just advisory and also on advisory, I think we have to involve citizens more.

MR. BEHLKE: Thank you.

MR. CLARE: Thank you very much, this has been very helpful and I hope we have allowed you enough time to meet your deadline.

That concludes the statements of people who have indicated statements, is there anyone else that would like to make a statement?

MR. LE MEIR: Can you ask a question of the panel?

MR. CLARE: Does the panel want to make -- answer -- we'd rather you make a statement.

MR. LE MEIR: I'll classify it as a statement if you want, my name is Emanuel LeMeir, I'm from Olympia, Washington. There has been considerable discussion or reference to regions and regional planning and the question I would like to ask of Mr. Kirry on the panel or anyone else is what is the definition of a region, and I also would say that a definition relative to region should be included in your deliberations when this comes up, whether this is a county, state, several states, so I will go back and reiterate what is the definition of a region here which has been discussed at this meeting and also in Seattle.

MR. KIRRY: I would submit to that.

MR. CLARE: Very well.

MR. KIRRY: The State Planning and Community Affairs Agency has established or divided the state up into 13 regions; now these regions are not necessarily permanent for all times, but for coordination of planning at the state level it appeared necessary, it is difficult to plan very intelligently exclusively on a statewide basis as a single unit, so to give, to make it more easier and logical, the state has at least been tentatively divided up into these 13 regions, the regional boundaries being coterminus with county boundaries. These regions were determined based on travel patterns, similar economic activity, centers of population, social and economic characteristics. Now they were intended primarily to have common geographical base for planning of the various state functions. Hopefully they may be also useful and adaptable for -- as common bases for planning from the local point of view. There are some difficulties, of course, with these particular regional delimitations in that it is difficult to reconcile completely with say water drainage basins and this sort of thing. We tried to take this into consideration, but it is more or less more oriented to people, social and economic drainage basins, to use that term, so it was basically intended for coordination of planning at the state level, so this is what we are using as a guide for planning at this point. I might also comment that this was stimulated largely or in part at least by federal administrative policy which did require the state to make such a delimitation for the coordination of federal programs that did require some delineation of regions.

He is holding up a copy which summarizes these regions and the rationale behind them and it is possible that hopefully they can be used in some way in following through with Mrs. Guenther's suggestions and possibly in connection with the purpose of this hearing.

MR. CLARE: Mr. Kirry, would it be helpful for the record to identify the document?

MR. KIRRY: Yes, you might give the exact title; copies are available from our office here.

MR. WILLIAMS: You may have that for the record if you like.

MR. KIRRY: It's entitled "Development Areas" and it has been recently published by the State Planning and Community Affairs agency; additional copies are available from our office in Olympia.

MR. CLARE: Sir, would you care to make a statement?

CLARKE M. WILLIAMS

MR. WILLIAMS: I am Clarke Williams, chemical engineer, who has been working for 35 years in creating a pollution problem, I am trying to abate it. I will soon be retiring so I will be speaking as a private citizen rather than an advocate of any company.

MT. CLARE: Would you want to come up here, please.

MR. WILLIAMS: Thank you. You'll find my name, I had not intended to make a statement, but I will. During the last 35 years the company for which I've worked has employed me to do a lot of pollution abatement work. I am a chemical engineer. We have tried to reduce the oxygen ban of our effluent discharge into the harbor, we have tried to reduce the quantity of suspended solids both from the paper mill and from log washing and from the stream work, our efforts have been very successful, we have greatly reduced both the pollution load of solids and of suspended and dissolved solids. It has been a struggle, at times we have been fighting against oyster men, at times we've been fighting against state authorities, I believe, though, in the last five years the state authority has been strengthened to where it is no longer standing on the sidelines where we are fighting, but actually can come in and say this you should do, this you must do, tell us what you can do and we will help you do it, and I believe that the best place to put the authority and the responsibility for this estuarial improvement is with the state itself. This is close enough to be reached by our communications, it is close enough to know what we are doing, it is close enough to enforce our doing what we should do.

Thank you.

MR. CLARE: Thank you, Mr. Williams. Does anyone have a question?

MR. WASTLER: I have a question I would like to ask Mr. Williams if I could. As one chemical engineer to another, I was wondering if any thought had been given or your comment upon instead of just preventing the effects of waste on the environment of managing these wastes so as to enhance the environment. If I may give you an example of what I am talking about, in some of the colder areas of the world, up in the State of Maine for example, considerable effort is being directed toward using the thermal discharges of some power plants to enhance the lobster fishery, that type of thing is what I mean, but perhaps on a more subtle chemical or biological level.

MR. WILLIAMS: We have made efforts to reclaim economic values from what used to be waste, at one time they burned all of the wood that wasn't going to planks and plywood and into paper and now all of this apparent waste wood is being salvaged and more and more is being brought from the timber lands to be processed into usable materials. We have spent a great deal of money and we are getting some economic benefit from the study of what to do with bark, which once upon a time went into the river, separated from logs or otherwise just plain wasted into the river. We have done a great deal of work on recovery of the lignins which were at one time a waste and went into the river and which are now used for various by-products, we now burn and recover chemicals which once went into the river to re-use them, there is a world shortage of sulphur and much of the sulphur is now recovered and re-used, as for recovering and beneficiating the waste heat, in Scandinavian countries they are doing this to some extent, this low grade heat can be re-used to some extent for heating of rivers and such to avoid ice formations, but we haven't been able to do that here. I'm sorry I don't know more about it.

MR. WASTLER: Thank you very much.

MR. CLARE: Any other questions?

MR. BEHLKE: Off the record.

(Discussion held off the record)

MR. CLARE: Back on the record. Any other questions? Thank you, Mr. Williams.

MR. VLASTELICIA: Mr. Chairman, I would just like to acknowledge three statements that we did receive in the mail and they will be made part of the record of these meetings; the first is from Congressman Thomas M. Pelly, your representative in Congress from the First District, he asked that his statement be read aloud at the Seattle meeting, but we did not receive it until July 23rd, we received it in Portland the day of the Seattle meeting, but it will be included in the meeting record. We received a statement from the Skagit County Park and Recreation Board signed by Ann H. Wolford, and it will be included in the transcript, and another statement from the Washington State Association of County Park Boards and Departments, also signed by Mrs. Wolford, and these will be included in the transcript.

MR. CLARE: Mr. Williams, it's been 29 years since I received a piece of paper that I also am a chemical engineer, but I've been away from it so long that I hesitated to even say that much.

Are there any others here who would like to make a statement?

MRS. SHACKLEFORD: Mr. Chairman, I would just like to make one more statement about Hood Canal, it's a long, long, narrow body of water, it's about 75 miles long and it would take from 22 to 30 years for the water to completely change because before the tide gets all the way out it starts coming in again, so if it ever became seriously polluted, it would be an enormous task to ever clean it up, so we feel prevention is worth much.

MR. CLARE: Thank you; these tidal actions certainly do complicate a solution of many of our problems.

Are there any other statements? Again I want to thank all of you for coming and helping us get together this information, which will be very useful in completing the National Estuarine Pollution Study and giving us information which we can use in preparation of our report which our secretary will present to the Congress in November '69.

Mr. Behlke, do you have anything that you want to say before we close the session?

MR. BEHLKE: I don't believe so.

MR. CLARE: Thank you very much, and if there are no other statements or comments, we stand adjourned.

(Whereupon, at 12:15 o'clock p.m., Thursday, July 25, 1968, the hearing in the above-entitled matter was adjourned.)

PART II

WRITTEN STATEMENTS

Columbia River Fishermen's Protective Union

ORGANIZED - 1884

PHONE 325-2702

322 10TH STREET
ASTORIA, OREGON 97103

July 25, 1968

U.S. Health Education and Welfare
Pollution Control
Pittock Block 507
Portland, Oregon 97205

Gentlemen:

The Columbia River Fishermen's Protective Union wishes to be put on record stating that we believe that our Estuaries must be protected as near their natural state as humanly possible. We feel that without adequate protection to the aquatic life within our estraries we could concievably loose our oysters, clams, salmon and many other fish, plus some birds and other aquatic life.

The estuary areas of Oregon and Washington are probably some of the most valuable in the world. So the Columbia River Fishermen's Protective Union urgently urges the Federal Water Pollution Control Authority to do everything within their power to see that they are protected.

Sincerely,

COLUMBIA RIVER FISHERMEN'S
PROTECTIVE UNION

Russell Bristow

Russell Bristow
Executive Secretary

cc:
Thor Tollefson

"MAXIMUM-HARVEST-CONSISTENT-WITH-SUSTAINED-YIELD"

Public Hearing on HR 25
Conduct an Inventory and Study of the Nation's
Estuaries and their Natural Resources.
June 3, 1968
Presented by Bert L. Cole
Commissioner of Public Lands
Olympia, Washington

At the time of statehood the State of Washington asserted its ownership to the beds and shores of all navigable waters in the state. While the state has sold certain tidelands and shorelands throughout the years, the state still retains ownership in several thousands of miles of these tide and shorelands.

The state has never disposed of any of the beds of navigable waters and thus it is the single and only owner of beds of navigable waters within and adjacent to the state.

As the elected Land Commissioner of the State of Washington and the Administrator of the Department of Natural Resources, it is my responsibility to administer these state-owned lands along with some three million acres of state-owned uplands.

The Department of Natural Resources has a most obvious interest in any federal legislation relative to the estuaries in the State of Washington. Proper management of these estuaries hinges upon the balance of both compatible and conflicting uses. Compromises between competing uses will have to be made. We strongly feel that these judgment decisions concerning the management of estuaries within and abutting to the State of Washington can best be made within the State of Washington by the people of the State of Washington through their elected officials who must answer directly to the vote of the people of the state.

At the same time we recognize a federal interest and responsibility for all of the nation's estuaries. Major emphasis should be placed upon maintaining state and local management but we believe that it is proper for the federal government to assist, guide, and in those few instances where a state may default in providing a reasonable program for the management of its estuaries, to protect the estuarian resources.

While we had vigorously opposed earlier drafts of the National Estuarian bill because we felt that it encroached upon the basic prerogatives of the state and because of other specific provisions contained in those earlier drafts, we are generally agreeable to the present HR 25. We feel that the wording in HR 25 will reflect a sincere desire on the part of Congress to cooperate with and assist the states. Our only apprehension comes from the knowledge that future federal administrative agencies and officers may not recognize or acknowledge this cooperative spirit. It seems that all too often an over-zealous federal administrator acts in almost direct opposition to the avowed intent of the Congress. We know of no real remedy for this administrative problem. We do believe that it is proper for the federal government to have some responsibility for protection of the nation's estuaries. With responsibility must go some degree of authority. Hopefully, the federal administrator will recognize that with that authority goes some degree of responsibility.

June 3, 1968

STATE OF
WASHINGTON
DANIEL J. EVANS
GOVERNOR

DEPARTMENT OF
FISHERIES
THOR C. TOLLEFSON
DIRECTOR

ROOM 115, GENERAL ADMINISTRATION BUILDING
OLYMPIA, WASHINGTON 98501

August 1, 1968

Mr. John Vlastelicia
Federal Water Pollution Control Administration
570 Pittock Block
Portland, Oregon 97205

Dear Mr. Vlastelicia:

Reference is made to the hearing on estuary pollution held on July 25, 1968, Aberdeen, Washington by your agency and the Washington Water Pollution Control Commission. We wish to have this letter entered as part of the hearing record as per verbal notice that statements would be accepted for 15 days subsequent to July 25, 1968.

We consider the geographical boundaries of the Grays Harbor area to extend from the ocean jetties upstream to Montesano. These waters have had a long history of poor water quality conditions attributed to the presence of sulfite waste liquor, domestic sewage, dredging, gravel washing, etc. Low streamflows, warm water temperature, and ocean upwellings are phenomena that have aggravated existing water quality.

Several investigations have scientifically demonstrated that a water quality problem exists. The problem:

1. The dissolved oxygen (DO) of the water in the upper estuary has sagged to 1.5 ppm in the summer months.

2. Toxicities exist even during periods when the DO of these waters is within a favorable range (5 ppm or more).

3. Phytoplankton photosynthesis is severely inhibited by turbid conditions due to silt from dredging.

4. During the period 1962 through 1967 there have been major fish kills, observations of distressed fish and minor fish kills, reversal of the upstream migration of adult coho, plus numerous instances of resident and anadromous fish and shellfish in a lethargic condition.

Bioassays in marine waters of Grays Harbor from 1961 to 1967 show the areas of toxic conditions in the estuary and substantiate the existence of unfavorable water quality for fish and shellfish. (Figure 1).

Increased percent abnormal oyster larvae over controls are indicative of toxic conditions and the results of our sampling show that positive toxic levels do exist.

Keep Our Waters Clean
POLLUTION KILLS FISH

Statistics on the production of oysters produced in Grays Harbor without information of the seed planted, market demands, and other closely allied conditions associated with the oystering industry are almost meaningless.

For example, the average yield of oyster meat per case of seed planted in lower Grays Harbor is six gallons, while in Willapa Bay the yield is 15 gallons of oyster meat per case of seed planted.

A statement by Mr. Lowell McGinnis, I.T.T.-Rayonier, Inc., Hoquiam, at the July 25, 1968 hearing inferred that water quality in Grays Harbor was compatible with the shellfish industry.

We feel it more appropriate to conclude that the water quality of Grays Harbor is considered compatible with marginal survival of oysters but antagonistic to achieving maximum potential production and growth.

Summary - The expansion of industry and the population growth have apparently overshadowed any gain in the abatement of water pollution in upper Grays Harbor. Pollution control efforts have been made to avoid or minimize the occurrence of major observable fish kills. There is evidence of "marginal conditions", described here as the conditions "in between" those which are lethal and those favorable to fish and other aquatic organisms. Marginal water quality conditions generally prevail in upper Grays Harbor for prolonged periods of time. These are the most difficult to delineate and control, since they seldom cause directly observable fish losses, but do result in significant losses over long periods by reduction of survival rates of fish and shellfish and prohibit their achieving maximum potential production and growth.

Very truly yours,

Thor C Tollefson

Enclosure

Thor C. Tollefson
Director

cc: James Behlke, Acting Director,
Washington Water Pollution Control Commission

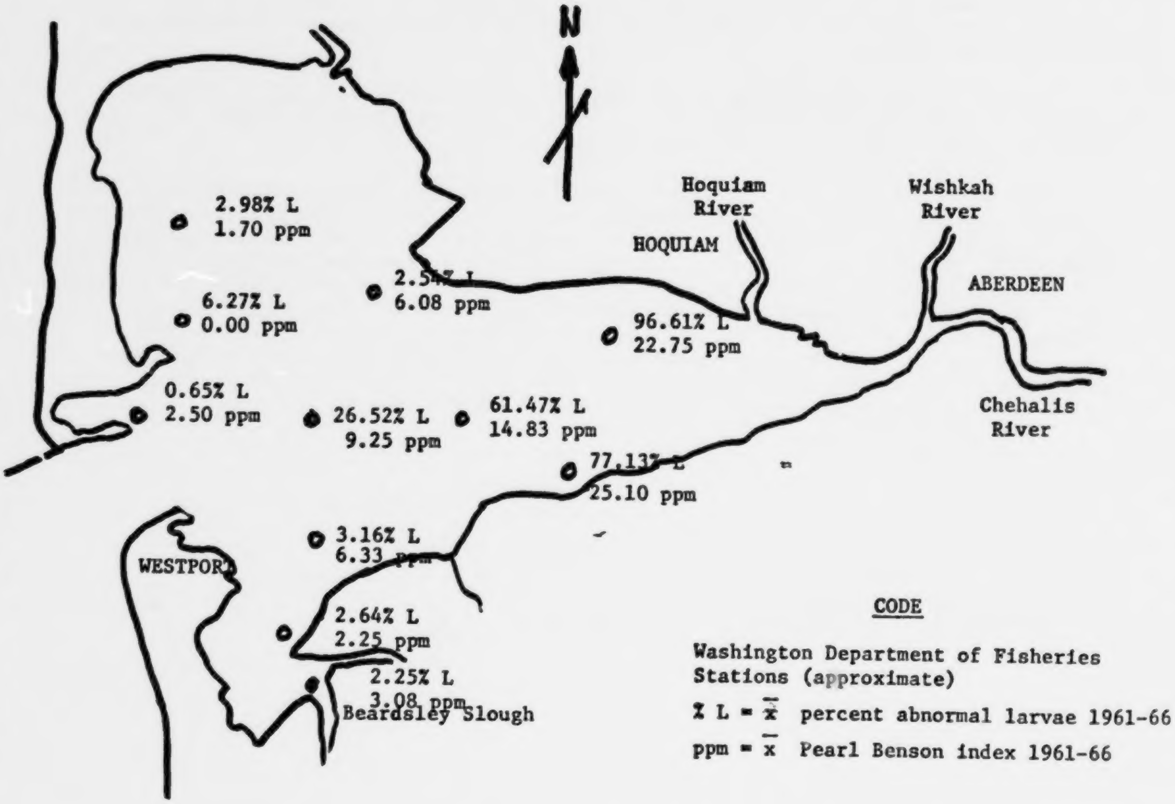

N
2.98% L
1.70 ppm
6.27% L
0.00 ppm
2.54% L
6.08 ppm
Hoquiam
River
HOQUIAM
Wishkah
River
ABERDEEN
96.61% L
22.75 ppm
0.65% L
2.50 ppm
26.52% L
9.25 ppm
61.47% L
14.83 ppm
Chehalis
River
77.13% L
25.10 ppm
3.16% L
6.33 ppm
WESTPORT
2.64% L
2.25 ppm
2.25% L
3.08 ppm
Beardsley Slough
CODE
Washington Department of Fisheries
Stations (approximate)
% L = $\bar{x}$ percent abnormal larvae 1961-66
ppm = $\bar{x}$ Pearl Benson index 1961-66

Figure 1. Outline of Grays Harbor, Washington

Grays Harbor
Soil and Water Conservation District

Room 6 • 100F Building • Montesano, Washington

John Vlastelicia, Regional Coordinator
National Estuarine Pollution Study
Federal Water Pollution Control Administration

7/22/68

Dear Sir;

The board of supervisors of Grays Harbor Soil & Water Conservation District considers sediment to be a major pollutant of estuarine water.
Siltation caused by the erosion of unprotected stream and river banks contributes in excess of 2,000,000 tons of sediments annually to the drainageways of this county. A large percentage of these sediments ultimately end in the estuaries.
River and streambank stabilization, erosion control and upstream watershed treatment are essential to the beneficial management and usefulness of these estuaries.

Sincerly
John V Holcombe
John V. Holcombe
Chairman

THIS IS A STATEMENT OF THE GRAYS HARBOR CHAMBER OF COMMERCE, ABERDEEN, WASHINGTON, WHICH REPRESENTS THE CITIES OF ABERDEEN AND HOQUIAM, DIRECTED TO THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, NORTHWEST REGION, ROOM 570 PITTOCK BLOCK, PORTLAND, OREGON. BEING UNABLE TO APPEAR AT THE HEARING HELD AT THE MORCK HOTEL IN ABERDEEN ON JULY 25, 1968 IT IS REQUESTED THAT THIS STATEMENT BE INCLUDED AS PART OF THE RECORD OF THAT HEARING.

Gentlemen:

The Grays Harbor Chamber of Commerce for many years has supported and pressed for the application of the policy of Multiple Use to all of our Natural Resources.

The Chamber has appeared at many State and Federal Hearings in support of these principles.

It is the feeling of the Grays Harbor Chamber that an estuary is a Natural Resource, that its uses are certainly multiple, and that in the administering the varied uses should be recognized and protected.

In the State of Washington estuarial problems were recognized many years ago and the State accepted the responsibility of protecting the various uses by the formation of the Washington State Pollution Control Commission which undertook the complex job of establishing water quality standards for the estuaries of the State.

The Grays Harbor estuary is an excellent example of one that can accommodate several uses. We have pulp and forest products industries on Grays Harbor. We have a thriving shipping activity. We have both commercial and sport fisheries and a growing oyster industry. All of these activities are essential to the growth and prosperity of the Grays Harbor area and this fact is recognized and accepted by the principals.

Huge sums have been spent by Grays Harbor industries in attempting to solve the problems of waste disposal and substantial progress has been made toward the achievement of that goal. Recognizing the obligation they are constantly seeking refinements to existing processes and searching for new processes through continuing research.

The Grays Harbor Chamber feels that the State of Washington moved in an orderly manner toward setting Water Quality Standards as provided in the Federal Water Control Act of 1965. The Chamber also feels that the State is best qualified to establish and enforce Estuarine Regulations, as the differences in each body of water are more recognizable and more efficiently adjusted at the local level.

The Chambers of Commerce of Grays Harbor appeared at a State Pollution Control Commission hearing in Olympia more than 10 years ago and proclaimed the doctrine that by fully utilizing ever-advancing modern technologies, with the cooperation of industry, and some patience on the part of the State Control agencies, industry, fisheries, commerce and recreation could all prosper on the same estuary. It is amazing how far we have come along the road of fulfilling that prophecy and there is no doubt in our minds that the existing efforts of both the state and industry will eventually resolve all of the major problems.

We see no reason for the intervention of the Federal Government into an area where problem solving has been effective and there is every indication that it will continue to be so.

LOWER COLUMBIA RIVER SPORTSMEN'S COUNCIL

Wahkiakum, Cowlitz, Clark, Skamania and Klickitat Counties

WASHINGTON

IMPACTS OF POLLUTION ON WASHINGTON'S COASTAL WATERS*
Hearing in Aberdeen, Washington July 25, 1968

The Lower Columbia River Sportsmen's Council is pleased to be a part of this hearing today, and we thank you for the opportunity.

The values, both economically and esthetically, of our estuarine areas cannot be over-emphasized. The coastal marshes which are an interplay of fresh and salt water, provide an environment for many types of life, both acquatic and land-based.

Ducks, geese, snipe, rails and many other bird species utilize estuarine areas. Acquatic species, such as oysters, clams, crabs, channel bass and mullet, call the estuaries "home." There are fishes which divide their lives between salt and fresh water; salmon, striped bass, shad, river herring and eels. Over 90% of the total harvest of seafoods from waters off the United States are taken on the continental shelf, and two thirds of these are composed of species whose existence depends on the estuaries.

In 1960, estuarine dependent seafood resources provided the livelihood for some 90,000 commercial fishermen. The 2.8 billion pounds of seafood was worth some 59 million dollars on the wholesale market. This was above the 900,000 pounds caught by a million and one half anglers. Though it is a difficult task to evaluate recreational fishing, the Environmental Pollution Panel of the President's Science Advisory Committee reached a figure of 163 million dollars. Add to these statistics the millions of dollars spent on migratory waterfowl, and you have a formidable total.

Though estuarine areas are vital food producers, they are, at the same time traps for pollutants which can suffocate the acquatic life and poison the feeding grounds. With the addition of accumulated poisons in the bodies of migratory bird life, we can have a chain reaction of death to other species hundreds of miles away.

Nearly 60% of the population of the United States lives in a band some 250 miles wide bordering the coastline. Two thirds of the plants making agricultural pesticides, organic chemical products, paper mills, and 52% of petroleum refining plants are located in coastal states. With pollutants carried considerable distances down stream, and those which remain in suspension and not broken down, collect in the estuarine area. It does not take a detective force to see the net result on the inhabitants of these regions.

With more leisure and a larger degree of affluence, greater numbers of our population are investing in second homes, with many of these residences located along the sea coast. Real estate operators, recognizing an opportunity for quick and appreciable profit, are pushing for land fill and land clearing. Ironically, the very attraction is the object they ultimately destroy; so the dream John Doe had of picking oysters, digging clams or trolling in the bay in front of his retreat, is lost just by his very presence. And the presence of a thousand others like him who shared that dream. Improper disposal of his sewage very likely will deplete the oxygen content of the water, hence the destruction of oyster and clam beds.

Most everyone interested in pollution and its abatement, is familiar with the three case histories most often cited: Great South Bay off New York's Long Island, with agricultural and domestic sewage pollution; Raritan Bay in New Jersey with domestic and industrial pollution; pollution of Barnagat Bay, New Jersey with its "red tides", a problem not yet diagnosed.

In February of 1967, Senator Warren G. Magnuson of this state made the statement in a television interview that the Pacific Northwest would grow at a rate of 127% within the next ten years, as against a national average of 26%. This growth will produce more houses, more industry and less open space, and certainly more pollutants than now, unless we as citizens and responsible agencies are willing to do something about it. We can, by general apathy create an environment totally uninhabitable, or we can provide one which can be enjoyed. Development must be carried on in a systematic, enlightened manner and on a long term basis; not just the short term gain of which so many have been, and still are, guilty. That short term gain is only too evident with the present desire of water diversion of the Columbia River to the arid reaches of the Southwest where water tables have dropped simply because of overselling by get rich quick and get out just as quickly land speculators.

Some so-called "progress" oriented citizens have dreamed of a canal extending from Ilwaco, at the mouth of the Columbia River to Willapa Bay. Has anyone evaluated the cost to the future? We don't mean the cost of building the canal, we mean the loss to future generations of citizens. Just how many farms can we continue to take out of production, how many oyster beds, clam beds, salmon spawning streams can we destroy in the name of progress, and still maintain an adequate food supply for an ever expanding population? Future peoples will still have to eat, no matter how we develop; well, or indifferent. This canal is used as an example because it is on home base: we wouldn't dream of hazarding a guess as to how many others like it are being spawned in the minds of lawmakers and uncaring citizens at home,

Thermal installations and lowering of fresh water tables which induce saline infusion, all pose problems.

We suggest land developers, industrial interests, state pollution control personnel, state fish and game agencies and conservation citizen groups work as a closely knit organization, with the Federal Water Pollution Control Administration and the Federal Fish and Wildlife Service. This group should be small, as a large representation only serves to be an unwieldly one. We suggest this group endorse development objectives of coastal and estuarine areas; endorses and adheres to a basic, clean water program; adopt sound land management plans; prevent substandard development; protect ground water resources; recommend sanitary waste disposal and adhere to it. In our opinion, without these guidelines, man, animal, plant and fish life face a dismal future.

It is not sufficient to damn the polluters of the past; perhaps they had no vision of a time when clean water no longer existed. We cannot afford to risk condemnation by the future. That justified condemnation will be our legacy if we fail by ignoring our responsibilities.

Thank you.

Submitted by Adah Werkema, for

Larry Werkema, President
LCRSC
101 East 38th St.
Vancouver, Wash. 98663

STATE OF WASHINGTON
SOIL AND WATER CONSERVATION COMMITTEE

LIAM H. SCHMIDTMAN, WATERVILLE
CHAIRMAN
ERT WHITMORE, PULLMAN
VICE CHAIRMAN
YD HOWELL, MONROE
ERT E. TORPPA, GRAYS RIVER
E. "PAT" CLYDE, TOPPENISH
AURICE AHLQUIST, OLYMPIA
LOUIS L. MADSEN, PULLMAN

DIGERNESS, EXECUTIVE SECRETARY
SLEY R. SPENCER, CONSERVATION
FIELD REP.

AREA CODE 206, PHONE 753-6185
335 GENERAL ADMINISTRATION BUILDING • OLYMPIA, WASHINGTON 98501

DANIEL J. EVAN
GOVERNOR

July 30, 1968

John Vlastelicia, Regional Coordinator
National Estuarine Pollution Study
Federal Water Pollution Control Admin.
570 Pittock Block
Portland, Oregon 97205

Dear Mr. Vlastelicia:

I am G. C. Digerness, Executive Secretary of the Washington State Soil and Water Conservation Committee, 335 General Administration Building, Olympia, Washington.

While attending your recently scheduled Esturarine meeting at Aberdeen, Washington, I noted the effort made by the panelists to secure comments from those giving testimony as to what effect land use above the estuary contributes to its pollution. I noted also an almost total evasion or disregard of this problem on the part of those making comments.

It is my understanding that this subject was well covered at your meeting in Seattle, especially by Mr. Conrad Hougen, President of the Washington Association of Soil and Water Conservation Districts.

Even though each of the soil and water conservation districts had received a notice of the meetings from Mr. Hougen, they did not respond for one reason or another, although I understand that they will be submitting testimony prior to August 9, 1968.

Sediment is a major pollutant of water and has and does contribute significantly to the pollution of our estuaries.

In each of the counties adjacent to the Pacific Ocean, Columbia River or Puget Sound, there is an active soil and water conservation district which does attempt to focus attention on soil and water problems, including that of our estuaries, has inventoried our soil and water resources and developed long-range comprehensive programs to fully utilize, develop and protect these resources and to provide the land occupiers with technical help to bring this about.

All of us are aware that more intensive and detailed studies are needed to determine the extent and source of pollutants and their effect on the ecology of our estuarine areas. I would like to mention a few areas of concern that relate to the land above or adjacent to an estuarine area as possible contributors to the gradual eroding of their value for many beneficial uses.

All streams in western Washington carry a heavy sediment load, much of which is deposited in our estuarine areas. It is not too firmly established from what source or sources this load originates.

Agriculture generally is a major contributor. In western Washington, this may not be true. The majority of our land is under adequate cover. Cropland is usually found only on our more comparatively level lands. A study should pin point, the areas that need adequate land treatment and steps taken to accelerate work in this region.

Our streams do a considerable amount of cutting along their banks, especially at flood stage. I suspect that much of our sediment load originates at such sources. A study should determine the extent of damage and corrective measures taken to halt such erosion. Soil and water conservation districts have provided considerable technical assistance and together with financial aid from Federal, State and local sources, the land occupier has riprapped many of the more vulnerable areas. Inasmuch as long-range watershed programs need at least a one-to-one cost benefit ratio to qualify for Federal and State assistance, to aid in establishing a satisfactory figure, sediment damages to an estuary should be assessed along with other damages such as loss of land, floods, etc.

When changes in land use take place to provide sites for industry, highways, airfields, homes, etc. invariably all cover is removed temporarily and extensive erosion can and does take place. A study should determine how extensive a contributor to our estuarine problem is this source of sediment and again regulations should be imposed to minimize the damage. Soil and water conservation districts are capable of providing land occupiers with the necessary soils information and soils interpretation supplied by trained technicians.

Suspects as a contributor to the sediment problem is our timber lands. We do not presently know the extent, but it may be significant. The major source may not be caused by poor logging methods, nor by improper road construction. What may be a major cause is the effects of the destructive logging practices of a long past era. Chief among these are the numerous fires which destroyed the forest duff.

Pin pointing the sources of sediment would help tremendously in identifying areas needing our most immediate attention.

Very few citizens think in terms of sediment when discussing pollution. As it is the major pollutant, it should have major emphasis as you document and analize the various aspects of estuarine pollution.

I am grateful for the opportunity to present a few thoughts and commend the Federal Pollution Control Administration for giving citizens an opportunity to be heard, as you consider a program for the preservation, study, use and development of the esturine zones in Washington State.

Sincerely yours,

C Digerness

G. C. Digerness
Executive Secretary

GCD:bjc

Thurston County
Soil and Water Conservation District

Courthouse Annex · Olympia, Washington 98501 · Phone 352-2903

August 7, 1968

John Vlastelicia, Regional Coordinator
National Estuarine Pollution Study
Federal Water Pollution Control Administration
570 Pittock Block
Portland, Oregon 97205

Dear Mr. Vlastelicia:

The enclosed statement relative to estuarine pollution has been personally reviewed and endorsed by the Supervisors of Thurston County Soil & Water Conservation District and is respectfully submitted for your consideration.

Thurston County is situated on the southern end of Puget Sound and is increasingly concerned with pollution problems. We have, naturally, emphasized the kind of pollution with which we are most concerned.

Respectfully,

George A. Whittaker Jr.
for
William Staatz
Chairman

Enc.

STATEMENT FROM THURSTON COUNTY SOIL AND WATER CONSERVATION DISTRICT
Olympia, Washington

For

NATURAL ESTUARINE POLLUTION STUDY

The traditional significance of soil erosion to farm minded people, is the loss of soil and the need for preventive measures. To the general public it is becoming increasingly evident that the significance of soil erosion is water pollution. A recent statement by Hollis Williams, Deputy Administrator of Watersheds, Soil Conservation Service, presented the essence of the problem in speaking to the Federal Water Quality Association, when he said:

> "Sediment, the product of erosion, and a plague to civilizations throughout history, is agriculture's major concern (in water pollution). Sediment transported by run-off water greatly exceeds in volume the combined total of all the substances that pollute our surface water. Volume-wise, such suspended solids in the nation's streams amount to, at least, 700 times the loadings caused by sewage discharge.
>
> Virtually all of the phosphate carried by streams is carried on sediment. Most of the pesticides carried in streams are carried on sediment.
>
> Sediment is a costly water pollutant. It constitutes a heavy economic drain in terms of loss of valuable top soil. It obstructs navigable streams. It damages aquatic life. It imposes a substantial cost on water supply agencies for water clarification. It causes excessive wear on hydro-power turbines and pump impellers.
>
> The deposition of sediment is depleting the storage capacity of reservoirs in the county at the rate of about one million acre-feet each year.
>
> Sediment affects every citizen. It means higher water bills, higher food and clothing prices, and higher taxes. Estimates indicate it is costing the people of the United States in excess of one-half million dollars annually."

Estuarine waters can be inserted into this quotation to make the thought more specific. Other items of damage can be added to provide a more complete inventory of pollution damage in these waters.

The Supervisors of Thurston County Soil and Water Conservation District wish to point out the inter-relation of land resource management and estuarine water control and the advantages of mutual assistance of involved agencies. Unless the general public can relate soil erosion to water pollution, it will hardly be concerned with the agricultural problems of soil erosion, nor will it grasp the major problem of quality control of estuarine waters.

We, therefore urge most strongly, that provisions made for abatement of estuarine pollution shall provide for assistance to and coordination with land conservation agencies.

The District Supervisors also urge that planning studies include the watershed areas involved.

Soil and Water Conservation Districts are subdivisions of state government and are enabled and authorized to develop and execute soil and water conservation programs in their geographic areas.

This district in its program, is presently committed to cooperate with federal, state and local agencies in the improvement of stream channels, and to control bank erosion. This program item may be enlarged when the need is discovered from studies as suggested above.

The basic law enabling these districts provides for using the assistance of other agencies so that coordination of a multiple agency effort through districts is feasible.

APPENDICES

A. Grays Harbor Water Quality and Its Utilization as a Resource. ITT Rayonier Inc. 243

B. Grays Harbor Water Quality and Compatibility of Uses, ITT Rayonier Inc. 271

C. Trends in the Chinook, Silver, and Chum Commercial Fishery in the Gray's Harbor and Willapa Bay Areas, Max Katz. 332

D. Trends in the Steelhead Sport Fishery in the State of Washington With Emphasis on the Fishery in Streams of the Puget Sound, Hood Canal and Grays Harbor Areas. Northwest Pulp and Paper Association 356

E. "Suicide in the Shallows" National Wildlife 401

F. House Bill No. 946, Chapter 139, July, 1967. 408

G. List of Speakers, Aberdeen Public Meeting 415

H. List of Attendees, Aberdeen Public Meeting 416

APPENDIX A

ITT RAYONIER
INCORPORATED
OLYMPIC RESEARCH DIVISION

MEMORANDUM

Date: January 13, 1967 No. G 10:1

Prepared by: J. E. Stein, J. G. Denison and S. G. Martin

Subject: GRAYS HARBOR WATER QUALITY AND ITS UTILIZATION AS A RESOURCE

ABSTRACT: Water quality conditions in Grays Harbor, especially the dissolved oxygen concentrations, were studied and related to biochemical oxygen demand (BOD). It was found that only a slight increase in water quality was noted when the discharge of BOD was decreased by approximately 56,000 pounds in September 1966. It was also found that, with past and present waste discharge conditions, oyster production and gill net landings in Grays Harbor compared favorably with those in Willapa Harbor where there are essentially no industries having great quantities of organic discharges. It was determined that under the best operating conditions, as exemplified in 1966, dissolved oxygen concentrations at or above 5 parts per million (ppm) did not occur more than 30 percent of the time during low flow periods and at the sag point. The average oxygen concentration was 4 ppm in the area of lowest concentration at the sag point. It was concluded that a standard of 5 ppm would be almost impossible to meet even if the amount of waste was reduced to 100,000 pounds of BOD per day. Another conclusion was that most, if not all, present uses of the waters of Grays Harbor are compatible.

INTRODUCTION

With the advent of the Water Quality Act of 1965, State agencies are requested by the Federal Government to formulate water quality standards for interstate waters. In setting the standards, it is required that the use of the resource be described. It is further required that the standards must allow the uses to be compatible and also enhance the water quality. In general, the essential task is to maximize water uses. One purpose of this memorandum is to describe present water uses. Another purpose is to ascertain if the uses are presently compatible under existing quality conditions.

METHODS AND PROCEDURES

Routine oceanographic and biological sampling procedures were used. Chemical analyses were carried out according to procedures set forth in Standard Methods.[1] The work was carried out by the technical staff of the Grays Harbor Division under the supervision of the Biological Investigations Section of Rayonier Incorporated. Fisheries statistics used in this memorandum were from publications of the Washington State Department of Fisheries.

OBSERVATIONS AND RESULTS

Grays Harbor Geomorphology

Grays Harbor, being a triangular shaped body of water, has the characteristics of a drowned river mouth (Fig. 1). At one time the river mouth was at or near sea level and the erosional action of ocean currents and waves was buffered by deposition of sediments carried by the river system. The deposition of sediments and the formation of a barrier beach restricted the mouth of the Harbor resulting in a reduction of water velocities within the Harbor. When water velocities decrease, the suspended matter drops out and thus intensifies silting.[2] The silting process continues to the present day and necessitates constant dredging to allow for the movement of large vessels in and out of the Harbor. The dredging of bottom deposits develops localized adverse water quality conditions which are manifested by low dissolved oxygen (DO) concentrations.

Oceanographic Conditions

From a dynamic point of view, Grays Harbor is considered a positive estuary whereby the contribution of fresh water by rainfall and river flow exceeds the evaporation of water from the estuary.[3] The inflow of river water is an important factor in the flushing and assimilation of wastes. The river flow varies with seasons; the highest flow occurs during winter and spring, while the lower flow occurs during summer and early fall. The minimum flow is generally during the months of July, August and September.

Water Volumes

The water volume of the Harbor from Montesano to its mouth at mean lower low tide is 102.21 billion gallons. At mean higher high tide, the water volume is 277.79 billion gallons, or nearly three times that of the water at mean lower low tide.

The deepest portion of the Harbor is in the main ship channel which is dredged to controlling depths of 23 to 30 feet. The relative shallowness of the Harbor, at low tide, is manifested by many extensive mud flats which generally precludes unobstructed navigation as well as water sports that require clear passage such as water skiing.

Figure 2 shows the accumulative water volumes of the Harbor starting at Montesano. From this figure, it is possible to arrive at a rough estimate of the minimum distance a particle of water will travel on any stage of the tide. Also, it can be seen that some of the floating, suspended or dissolved material present at a point 135 thousand feet from Montesano, on higher high tide, will leave the Harbor on the outgoing tide.

Oxygen Concentrations

During the periods of low river flow in the Chehalis River, less than 3,000 cubic feet per second (cfs), frequent survey trips are made. When the river flow decreases to 1,000 cfs, or less, daily trips are made. Each trip starts at, or near, low slack tide at Station 52 (Fig. 3).

Table I is a typical data sheet and shows the type of observations made and the sequence of sampling. Figures 4 and 5 show the average oxygen conditions as well as the minimum and maximum values observed during the months of August and September of 1966. During these two months, river flows were in the order of 561 cfs to 686 cfs. The average DO represents all observations made at each station, including surface, mid-depth and bottom determinations. The maximum value is the highest single value observed during the survey trip and the minimum is the lowest observed. The darkened areas of Figures 4 and 5 show the times at which the values were below an average of 4 ppm and a minimum of 3 ppm. Figure 6 shows a profile of the surface and mid-depth oxygen distribution in the North Channel for August 15, 1966. Note that on this particular day the minimum oxygen values occur at Stations 50, 51 and 52. The minimum values, observed at low tide, move in an easterly direction with the incoming tide. At high slack, the low values can be found as far east as the Standard Oil Dock; conversely, at low tide the minimum DO is found in the vicinity of Moon Island in the North Channel (Fig. 1).

The water volume of the dispersal and assimilation zone (from Stations 33 to 54) is 1.07 billion cubic feet at mean lower low tide or approximately 8.5 percent of the total lower low tide water volume within the Harbor. Generally, the lower low tide volume of water having the lowest oxygen values, as represented by the block of water in which Stations 52, 53 and 58 are found, is 0.34 billion cubic feet. This represents only 2.7 percent of the total lower low water volume in Grays Harbor. Figure 7 shows a cumulative frequency curve of oxygen concentrations occurring at these three stations during the months of August and September of 1966. From this figure, it can be seen at Station 52 that the oxygen values were below 5 ppm about 95 percent of the time, below 4 ppm approximately 55 percent of the time and below 3 ppm 5 percent of the time. For Station 53, the oxygen values were below 5 ppm approximately 75 percent of the time, below 4 ppm approximately 55 percent of the time and below 3 ppm 13 percent of the time. For Station 58, the oxygen values were below 5 ppm 68 percent of the time and below 4 ppm 43 percent of the time. No values were observed below 3 ppm at Station 58. During this period, the Chehalis River flow was below 1,000 cfs 98 percent of the time and below 500 cfs 38 percent of the time, as can be seen in Figure 8.

During a six-hour flood tide, approximately 170 billion gallons of oceanic water enter the Harbor. If the concentration of this water was 7 ppm, 10.2 million pounds of oxygen would be introduced. On the other hand, at a river flow of 670 cfs, only 6,500 pounds of oxygen are contributed providing the river water concentration is also 7 ppm. Therefore, the oxygen contribution by the ocean is over fifteen hundred times that contributed by the river. Even at a winter river flow of 20,000 cfs., the oxygen contribution would be only 193,650 pounds of oxygen at an incoming concentration of 7 ppm. From these data, it is concluded that the major oxygen source in Grays Harbor is not from the rivers but from the ocean.

BOD Discharge

In the summer of 1966, Weyerhaeuser had their treatment plant operating and Rayonier greatly improved the efficiency of their recovery plant. Inasmuch as the Rayonier recovery plant burns spent sulfite liquor (SSL), less SSL was pumped to the lagoon on Rennie Island in 1966. The reduced loading of SSL to the Island allowed for the discharge of bleach plant wastes into the lagoon instead of the receiving waters. Prior to the advent of the recovery system, the bleach plant wastes were discharged into the receiving waters. Figure 9 is a frequency curve of BOD discharge. The average discharge was approximately 87,000 pounds of BOD per day. This is one of the best performances ever realized by Rayonier. During the summer of 1966, the average Rayonier - Weyerhaeuser combined loading into the Harbor was about 143,000 pounds of BOD per day. Of this amount, Weyerhaeuser contributed an average of 56,000 pounds and Rayonier contributed an average of 87,000 pounds of BOD. Even at these relatively low loadings, the oxygen concentrations were below 5 ppm most of the time. It is concluded that a standard of 5 ppm would be impossible to meet under present operating conditions and river flow. Even if there were only 100,000 pounds of BOD discharged each day, the data indicate that 5 ppm would still be extremely difficult to meet at low river flow. It should be emphasized, at this time, that river flows do not necessarily increase the assimilative capacity in terms of oxygen supply. Instead, the river accelerates the dispersal function and thereby decreases the retention time. This is especially true because, as mentioned before, the oxygen contribution by the river is extremely small when compared with the oceanic contribution; moreover, the latter is a relatively constant renewing input. It is therefore concluded that the decreased oxygen values during the low-flow period, as contrasted to the winter period, is primarily due to an increased retention time rather than a lack of oxygen.

The flushing of waste by the river in 1965 and 1966 was essentially the same owing to the similarity in flow conditions. This is shown in Figure 8. The average river flows in cfs are shown in Table II. Owing to the similarity of river conditions for these two years, the oxygen deficit for September of each year is compared. The purpose of the comparison is to ascertain if the lower BOD discharge occurring during 1966 resulted in less of an oxygen deficit than that observed in 1965 when the BOD loadings were considerably higher. The August loadings from Weyerhaeuser and Rayonier for the years of 1965 and 1966 remained essentially the same. The total loadings for August of 1965 and 1966 were respectively 160,700 and 157,000 pounds of BOD. Consequently, the oxygen deficits for the month of August are not compared. However, the September loadings for 1965 and 1966 were very different; these loadings were respectively 192,900 and 137,000 pounds of BOD. From Table III, it can be seen that the deficit was only slightly less in 1966 than in 1965, in spite of a difference of 55,900 pounds of BOD loading.

The oxygen deficit is the difference between the observed oxygen concentration and the oxygen concentration that would occur at 100 percent saturation. It is assumed that, in order to attain 100 percent saturation, waste effluent would not be present; similarly, a natural phenomenon such as upwelling also would not be extant. It is also assumed, for Grays Harbor, that a deficit is created, primarily, by the discharge of wastes from Rayonier Incorporated and Weyerhaeuser Company. The use of the deficit concept eliminates variations in oxygen concentrations brought about by differences in water temperature and salinity from one year to the next.

Use of the Harbor

The easterly portion of the Harbor is primarily used for industrial purposes. The industrial area may be considered as extending from the western tip of Moon Island to the Chehalis River in the vicinity of the Standard Oil Dock (Fig. 1). This area has the following activities and uses:

1) Dispersal and assimilation of wastes
2) Navigation
3) Log sorting, storage and transportation
4) Ocean vessel docking, loading and unloading
5) Cooling water
6) Dredging to maintain channel depth
7) Upstream and downstream fish migration
8) Gill net fishing
9) Fish rearing and feeding

Compatibility of Uses and Activities

The gill net fishery for both Grays Harbor and Willapa Harbor is an inside fishery in that all fish are taken within the Harbor. The stocks of fish are native to these areas; consequently, individuals making up the population are subject, during upstream and downstream migration, to ecological conditions prevailing during these times. If the environment has a deleterious effect, the results should be manifested in the landing records. On the other hand, if landing records compare favorably with other areas where there are no industries having great quantities of organic discharge, it must be concluded that there is no apparent effects from the industrial effluents.

Figure 10 compares the gill net licenses issued at Willapa Harbor and Grays Harbor from 1935 through 1964. The 30-year averages of both areas are almost identical. At Willapa Harbor, an average of 130 licenses were issued each year in contrast with an average of 123 per year at Grays Harbor. Peak years in Willapa Harbor occurred in 1946 and 1958; the minimum years for that area were in 1939 and 1964. The peak years for Grays Harbor were in 1940, 1948 and 1960; the minimum years were in 1942 and 1955. During the latter four years, both areas showed a downward trend in the issuance of licenses. Both areas manifested similar cycles in the number of licenses issued during the 30-year period.

Silver salmon landings are compared for Grays Harbor and Willapa Harbor in Figures 11 and 12. The landing record is from 1935 through 1964. The statistics are in the form of catch per license issued; therefore, in a sense the data represent catch per unit effort. Both areas show similar cyclic variation. The peak catch per unit effort in Willapa and Grays Harbors occurred in 1952. After 1952, the landings in both areas declined in a similar manner. The decline in Willapa Harbor from 1951 through 1964 was at an average of 25 fish per license issued. In Grays Harbor, for the same period, the decline was 28 fish per license issued. From these data it is concluded that the decline in silver salmon caught in both areas was essentially the same. Therefore, the discharge of industrial wastes into Grays Harbor did not make any difference compared to Willapa Harbor where essentially no wastes are discharged. Trends were determined by regression analysis of the data in this and following cases.

Chum salmon are compared in the same manner as was done with the silver salmon in Figures 13 and 14. Here again, the curves are very similar and the decline in Grays Harbor from 1951 through 1964 was 50 fish per license while in Willapa Harbor it was 56 fish per license. It is again concluded that, on the basis of fish statistics, wastes discharged into Grays Harbor are not affecting the survival of fish in such a manner as to decrease the catch.

Chinook salmon are compared in the same manner as for chum and silver salmon in Figures 15 and 16. The curves for Grays Harbor and Willapa Harbor are very similar. From 1951 through 1964 both areas had a slight increase in production. This increase was so slight as to have no significance in terms of the amount of fish caught. However, both areas show similar cyclic trends of the same magnitude. It is therefore concluded that the discharge of wastes in Grays Harbor does not have a deleterious effect on chinook salmon survival and landings.

Oyster Production

Oyster production is extensively carried out at Grays Harbor in North and South Bay (Fig. 1). In this Harbor, even if the water temperature becomes sufficiently warm enough for spawning, there will still be little or no spat set. The spat fail to set because the larvae must be in the water in excess of thirty days before they set. This is impossible in the growing areas of Grays Harbor because of the rapid flushing time. The oyster larvae will be swept out to sea where they will be further dispersed. Only a few, if any, will return to the Harbor to set. Furthermore, the colder oceanic temperature is inimical to their survival. Consequently, it is concluded that Grays Harbor cannot be used as an area for oyster spawning and setting. However, it can be used for a growing area whereby spat are purchased elsewhere and placed in appropriate growing areas within the Harbor. An examination of oyster production records from Grays Harbor reveals that, compared to other places, this is one of the few areas which show increasing production.

When oyster production at Grays Harbor is compared with production at Willapa Harbor, where no extensive industry exists, it is seen that Grays Harbor production (based on records from 1935 to 1964) shows an average increase of 3,496 gallons per year. The average increase is based on regression analysis shown in Figure 17. In contrast, over the same period of time, production in Willapa Harbor has decreased at the rate of 11,174 gallons per year (Fig. 18). Consequently, it is concluded on the basis of these records that, within the limits of growing space, conditions for oyster propagation in Grays Harbor are the same or better than those existing in Willapa Harbor. It is also concluded that the dispersal and assimilation of waste in the more easterly portion of the Harbor, near Aberdeen and Hoquiam, does not create adverse conditions for oyster growing in North and South Bay; therefore, waste assimilation at the head of the estuary and oyster growing in the western portion of the Harbor is compatible.

CONCLUSIONS

1) Oxygen input into Grays Harbor is considerably greater from the ocean than from the rivers.

2) Lowered oxygen concentrations, during low river flows, are due to increased retention time.

3) In winter, high river flows decrease retention times; consequently, oxygen concentrations are higher. Lower winter temperatures decrease assimilation rates thereby further improving the dissolved oxygen.

4) Spatting in North and South Bay is commercially impossible because of the rapid flushing rate in that area.

5) In September of 1966, the lowest BOD loading occurred since 1930; yet, there was only a slight improvement in oxygen conditions.

6) The average oxygen concentration, during the August-September period of 1966, was only 4 ppm during the period of low loading. Many values were below 4 ppm, but very few were below 3 ppm.

7) Levels above 5 ppm of DO were not observed 70 percent of the time.

8) A level of 5 ppm, if set by the State, would vastly restrict waste discharge and, from a practical point of view, prevent the expansion and operation of a new mill and may even curtail present operations.

9) The fin fish and shellfish production records of Grays Harbor compare favorably with those of Willapa Harbor where there are no industries discharging large amounts of organic wastes. Consequently, it is concluded that all uses are compatible and that 4 ppm of DO does not have an adverse effect upon fish production.

J E Stein
J. E. Stein

J. G. Denison
J. G. Denison

S. G. Martin
S. G. Martin

mah/mbb
January 13, 1967

Project No. 19:71

REFERENCES:
(1) "Standard Methods for the Examination of Water and Wastewaters", Eleventh Edition, 1960, American Public Health Association, New York.
(2) George K. Reid, "Ecology of Inland Waters and Estuaries", Reinhold Publishing Corporation, New York, 1961, p. 74.
(3) John P. Tully, "Oceanography and Prediction of Pulp Mill Pollution in Alberni Inlet", Fisheries Research Board of Canada, Ottawa 1949.

TABLE I

UPPER GRAYS HARBOR SURVEY TRIP

Low Water @ 8:06 DST (Port Dock Reference) Date 9/29/66

Station	Time	*Depth	Temp. ° C.	Cl$^-$ g./l.	D.O.@ Sat. ppm	% Sat.	D.O. ppm	PBPM SSL	pH
58	0700	Surface	17.2	12.0	8.5	35	3.0	53	6.6
--		15'	17.0	13.7	8.4	38	3.2	53	6.9
--		36'	16.8	14.6	8.4	42	3.6	53	7.2
53	0730	Surface	17.0	12.3	8.5	41	3.5	51	7.0
--		15'	16.9	12.7	8.6	33	2.8	51	6.9
--		27'	16.8	13.5	8.5	35	3.0	57	7.0
34	0745	Surface	17.1	9.5	8.8	39	3.4	38	7.1
--		18'	17.0	9.5	8.8	41	3.6	36	7.2
52	0800	Surface	17.1	10.1	8.7	41	3.6	43	7.1
--		15'	17.0	10.9	8.7	36	3.1	46	7.0
--		37'	16.8	12.1	8.6	34	2.9	49	6.8
50	0820	Surface	17.0	9.4	8.8	42	4.1	41	7.0
--		15'	16.9	9.2	8.9	40	3.6	40	6.7
--		27'	16.7	10.5	8.8	36	3.2	50	7.0
163	0830	Surface	17.0	9.2	8.9	43	3.8	40	7.3
--		8'	16.9	9.6	8.9	45	4.0	46	6.8
99	0845	Surface	17.0	12.5	8.5	45	3.8	66	6.7
--		12'	16.8	12.6	8.6	35	3.0	59	6.7
685	0910	Surface	17.0	9.0	8.9	52	4.6	36	6.9
--		15'	16.8	9.8	8.8	40	3.5	36	6.7
--		33'	16.7	9.4	8.9	43	3.8	38	6.7
760	0950	Surface	17.0	7.9	9.0	50	4.5	37	6.9
--		15'	16.8	7.9	9.0	48	4.3	34	6.7
52	1020	Surface	17.1	11.0	8.6	40	3.4	48	6.6
--		15'	16.9	12.1	8.6	34	2.9	71	6.8
--		38'	16.6	12.9	8.6	35	3.0	54	6.6

* Surface sample 3' below surface of water.

TABLE II

Average Flows of Water Flowing in the Chehalis River During The Months of August and September in 1965 and 1966

Date		River Flow in cfs	Average Flows for the Two Months of Each Year in cfs
Month	Year		
August	1965	769.35	$\bar{x} = 694.59$
September	1965	619.83	
August	1966	561.45	$\bar{x} = 623.56$
September	1966	685.67	

TABLE III

Average Dissolved Oxygen Deficit for the Month of September in 1965 and 1966

Station	September 1965	September 1966
52	4.81	4.28
53	4.75	4.32
58	4.48	4.19

Oxygen deficit is defined as the difference between the observed concentration and that which would occur at 100 percent saturation.

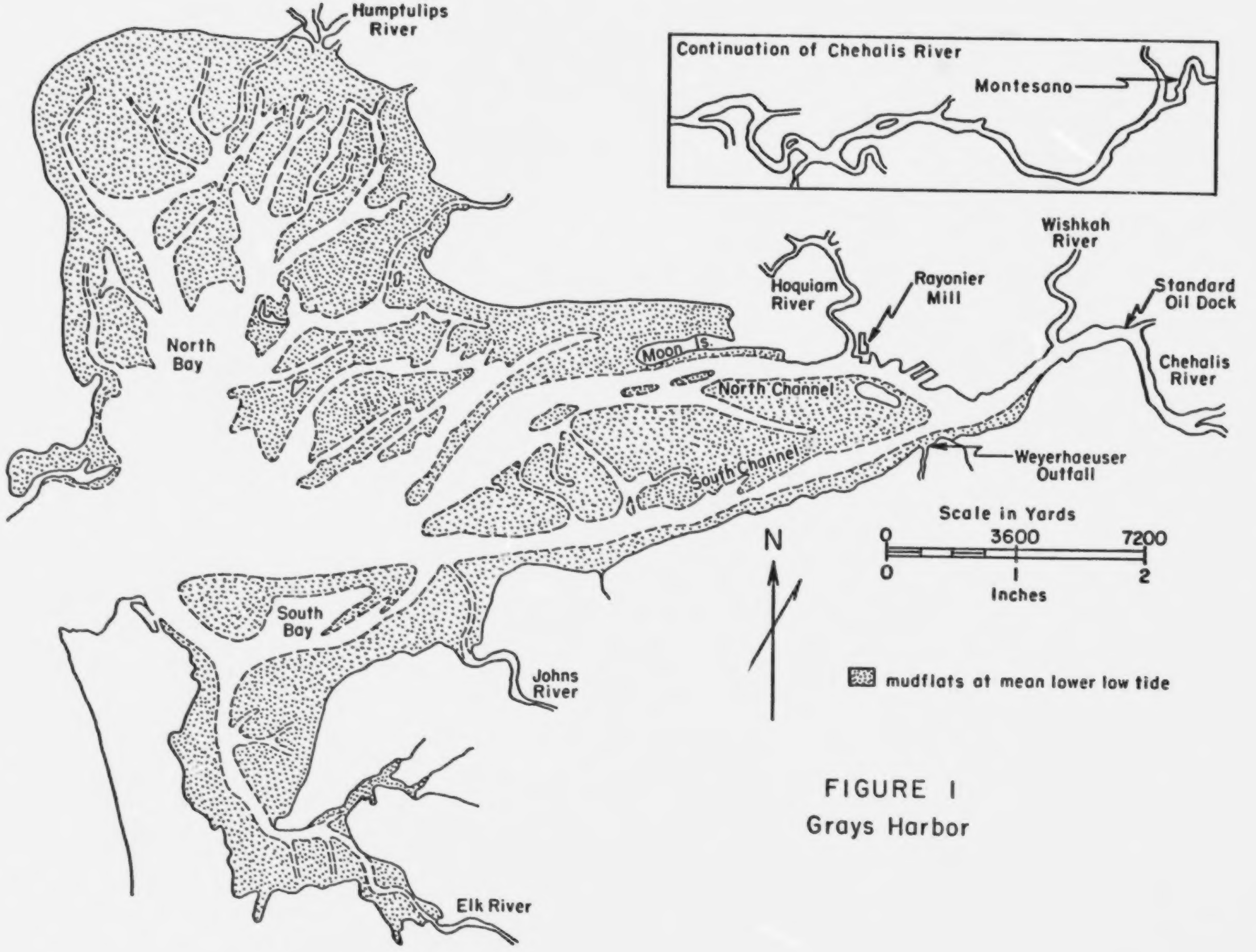

Humptulips River
Continuation of Chehalis River
Montesano
North Bay
Wishkah River
Hoquiam River
Rayonier Mill
Standard Oil Dock
Moon Is.
Chehalis River
North Channel
South Channel
Weyerhaeuser Outfall
Scale in Yards
0
3600
7200
0
1
2
Inches
N
South Bay
Johns River
mudflats at mean lower low tide
Elk River

FIGURE I
Grays Harbor

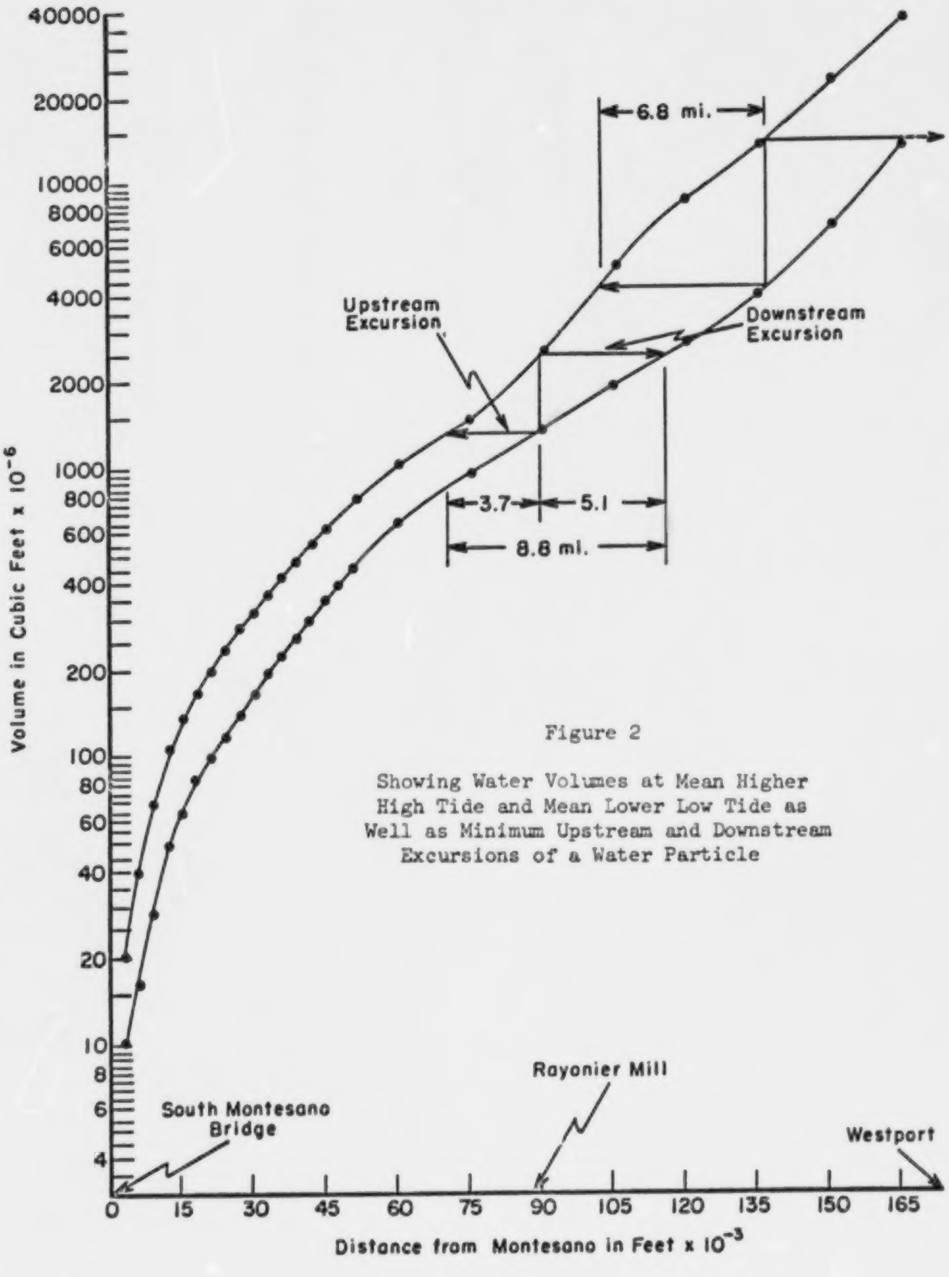
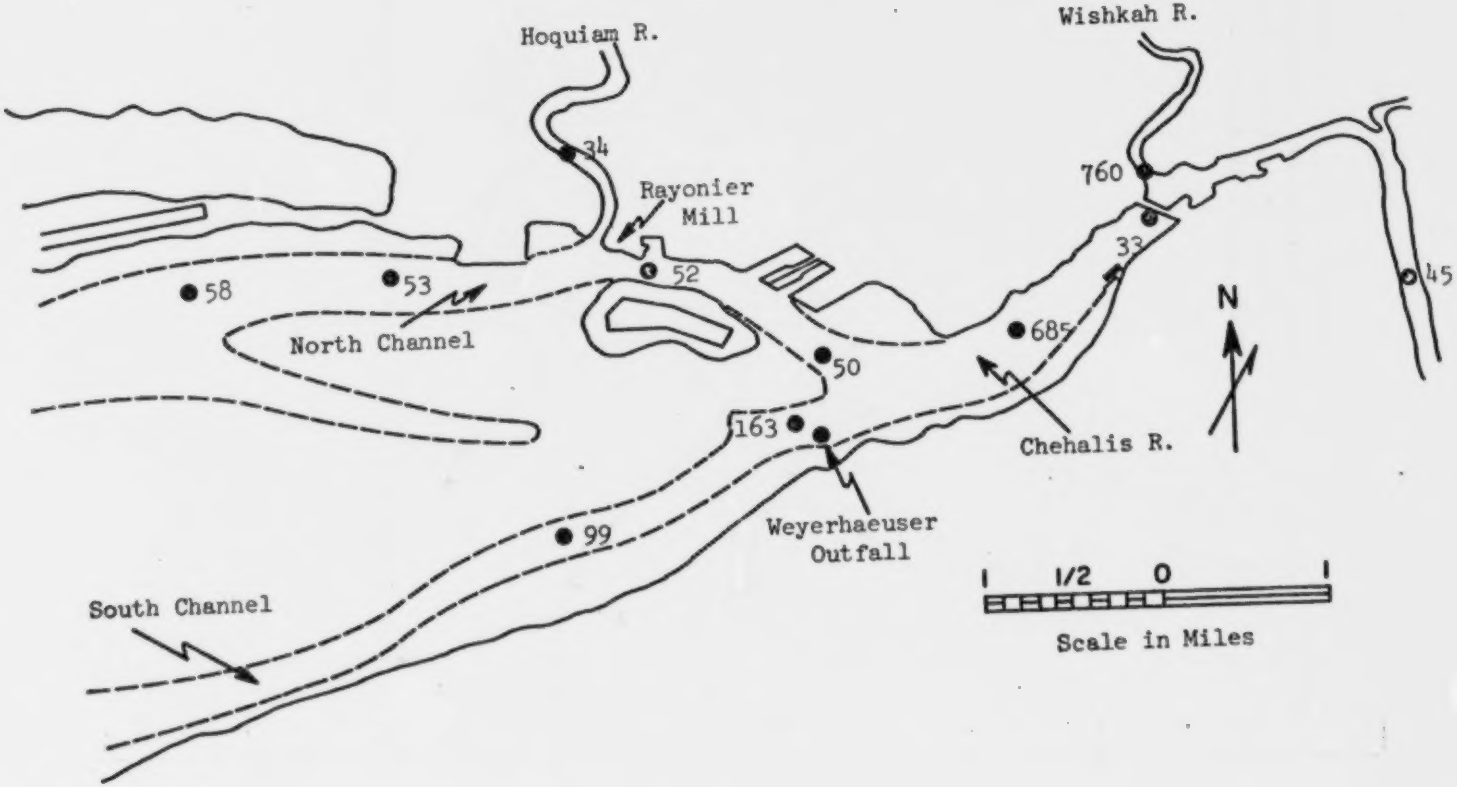


Figure 2

Showing Water Volumes at Mean Higher High Tide and Mean Lower Low Tide as Well as Minimum Upstream and Downstream Excursions of a Water Particle

Figure 3

Routine Short Water Trip Sampling Stations
of the Grays Harbor Division of
Rayonier Incorporated


Hoquiam R.
Wishkah R.
34
Rayonier Mill
760
33
52
58
53
North Channel
45
N
685
50
163
Chehalis R.
99
Weyerhaeuser Outfall
South Channel
1
1/2
0
1
Scale in Miles

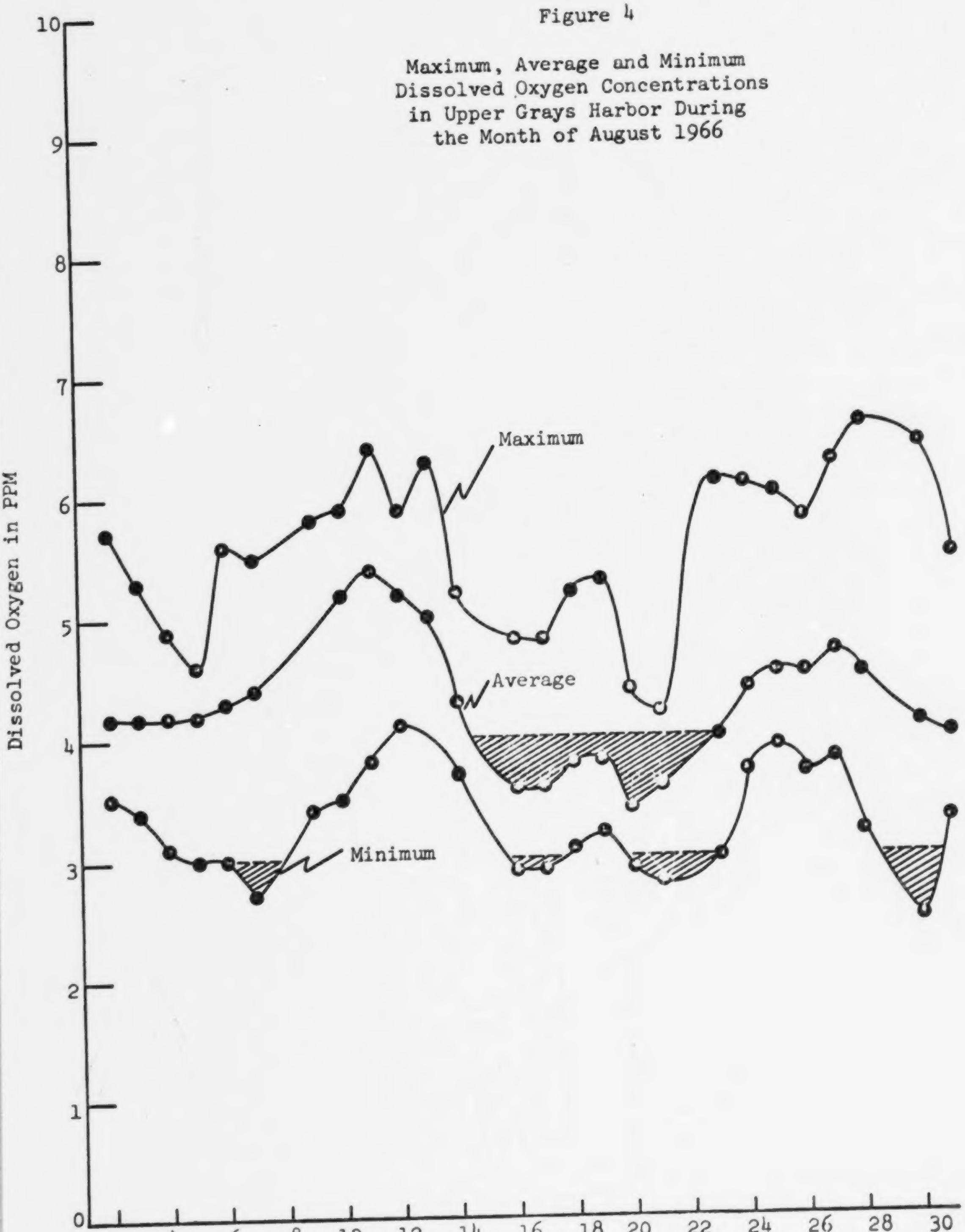


Figure 4

Maximum, Average and Minimum
Dissolved Oxygen Concentrations
in Upper Grays Harbor During
the Month of August 1966

Figure 5

Maximum, Average and Minimum Dissolved Oxygen Concentrations in Upper Grays Harbor During the Month of September 1966

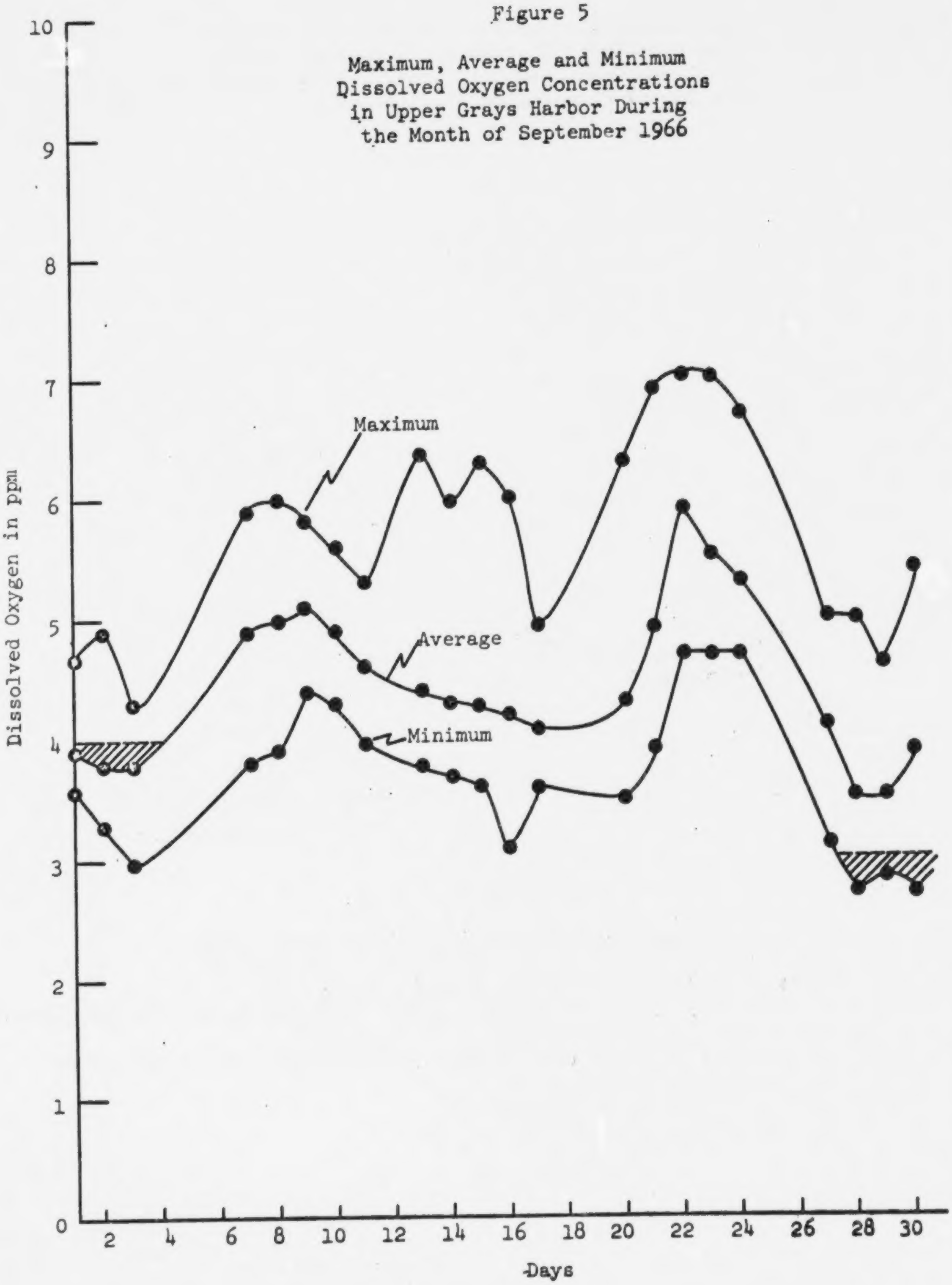


Figure 6

Grays Harbor Plot of D.O. (mg./l.) vs. Distance Downstream from Station 33 in Chehalis River. Data Taken from Long Trip Water Data on August 15, 1966 During Flooding or Slack Tides.

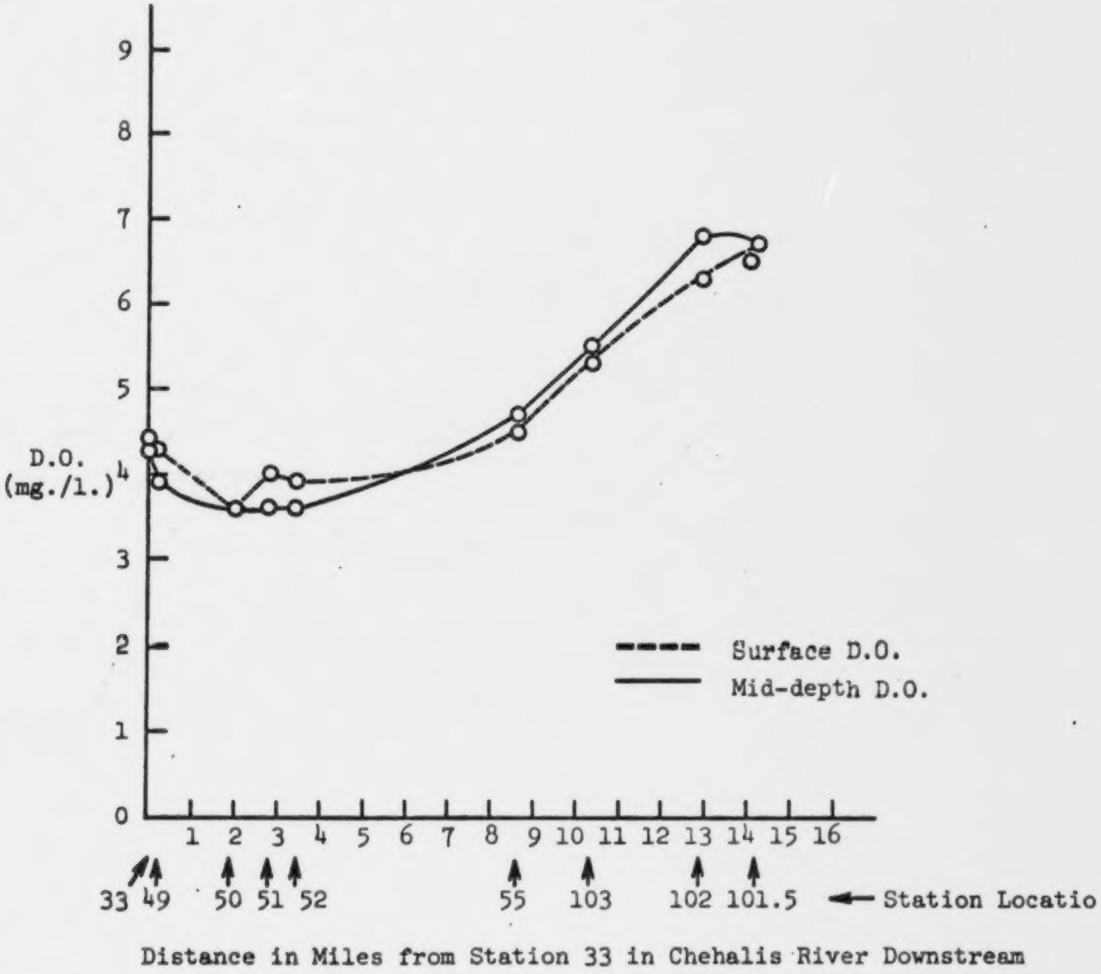


Figure 7

Cumulative Percent Frequency Distribution Curves of Dissolved Oxygen Concentrations at Stations 52, 53 and 58, for Aug. 1, 1966 to Sept. 30, 1966

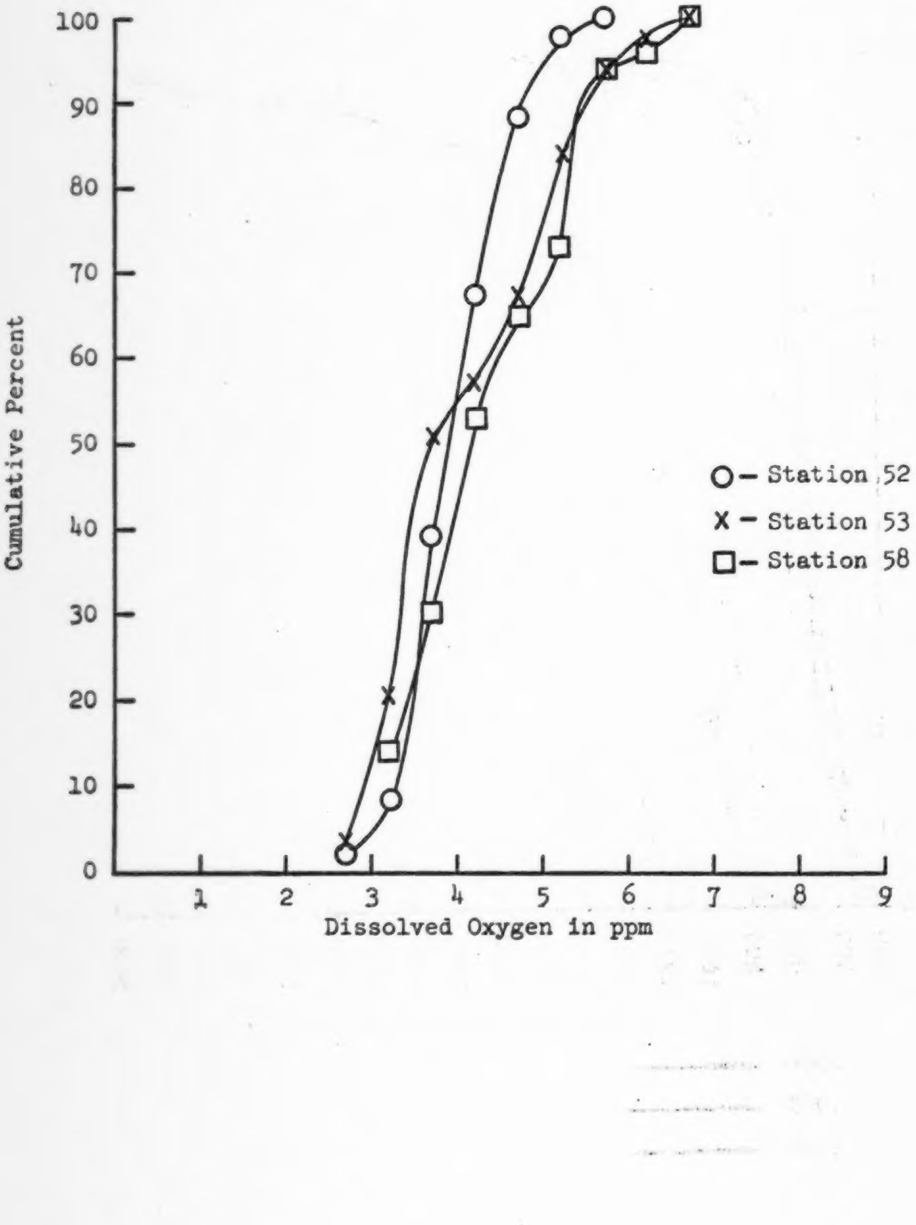


Figure 8

Cumulative Percent Frequency Distribution Curve
on River Flow (cfs) from Aug. to Sept. 30, 1964,
1965 and 1966

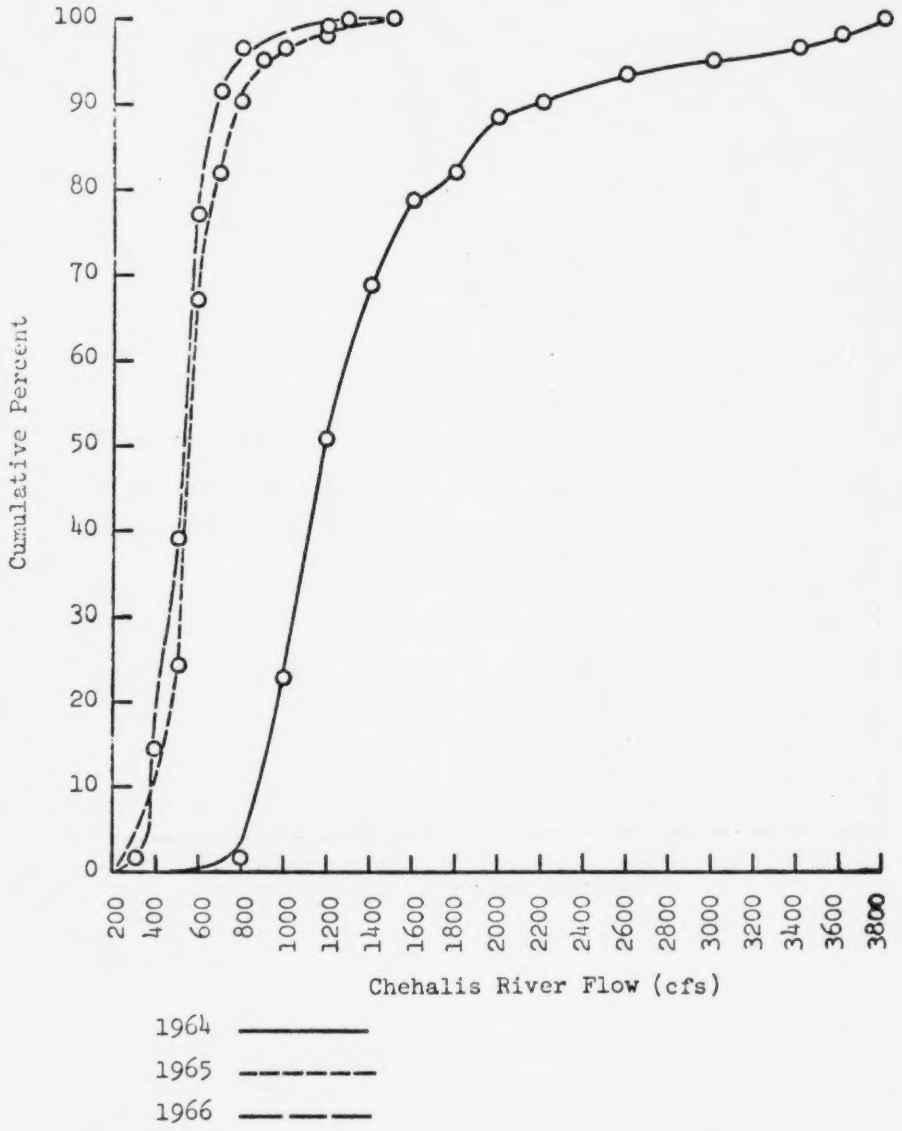


Figure 9

Cumulative Percent Frequency Distribution
Curve of BOD (pounds x 10^{-3}) of Diffuser
Outfall from Aug. 1 to Sept. 30, 1966

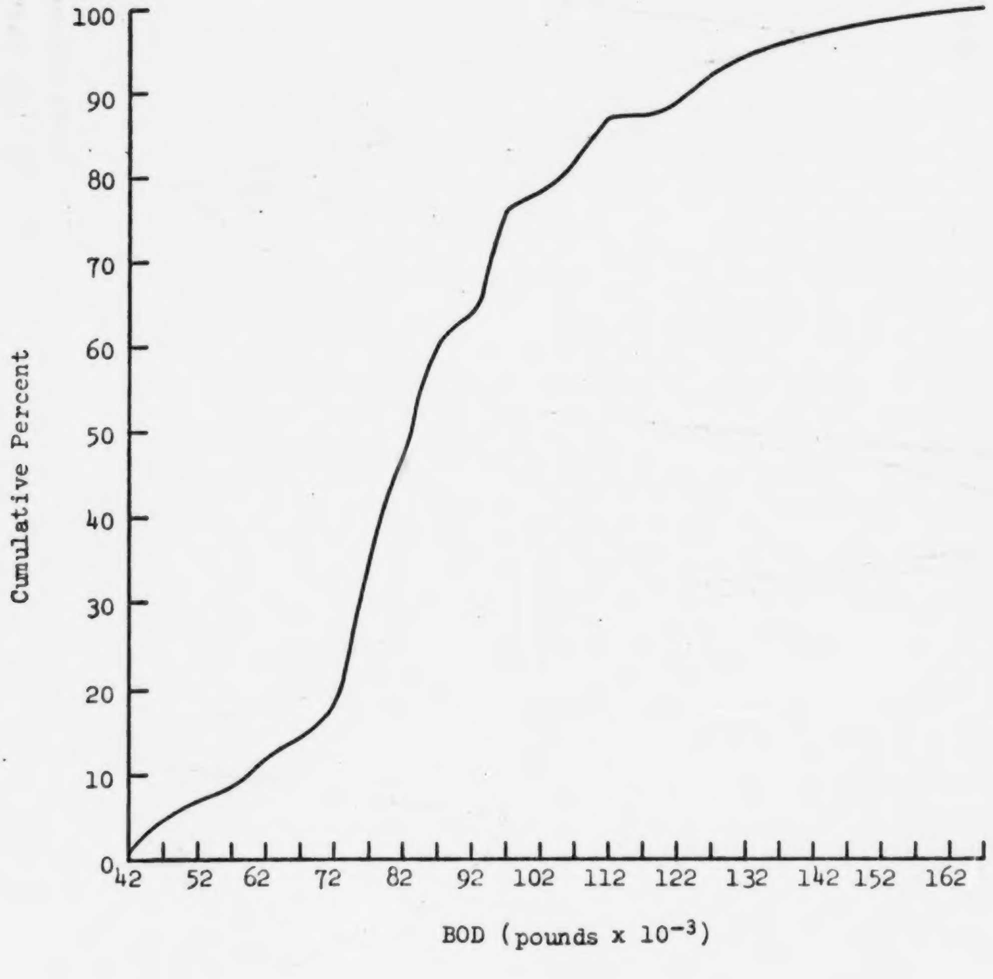
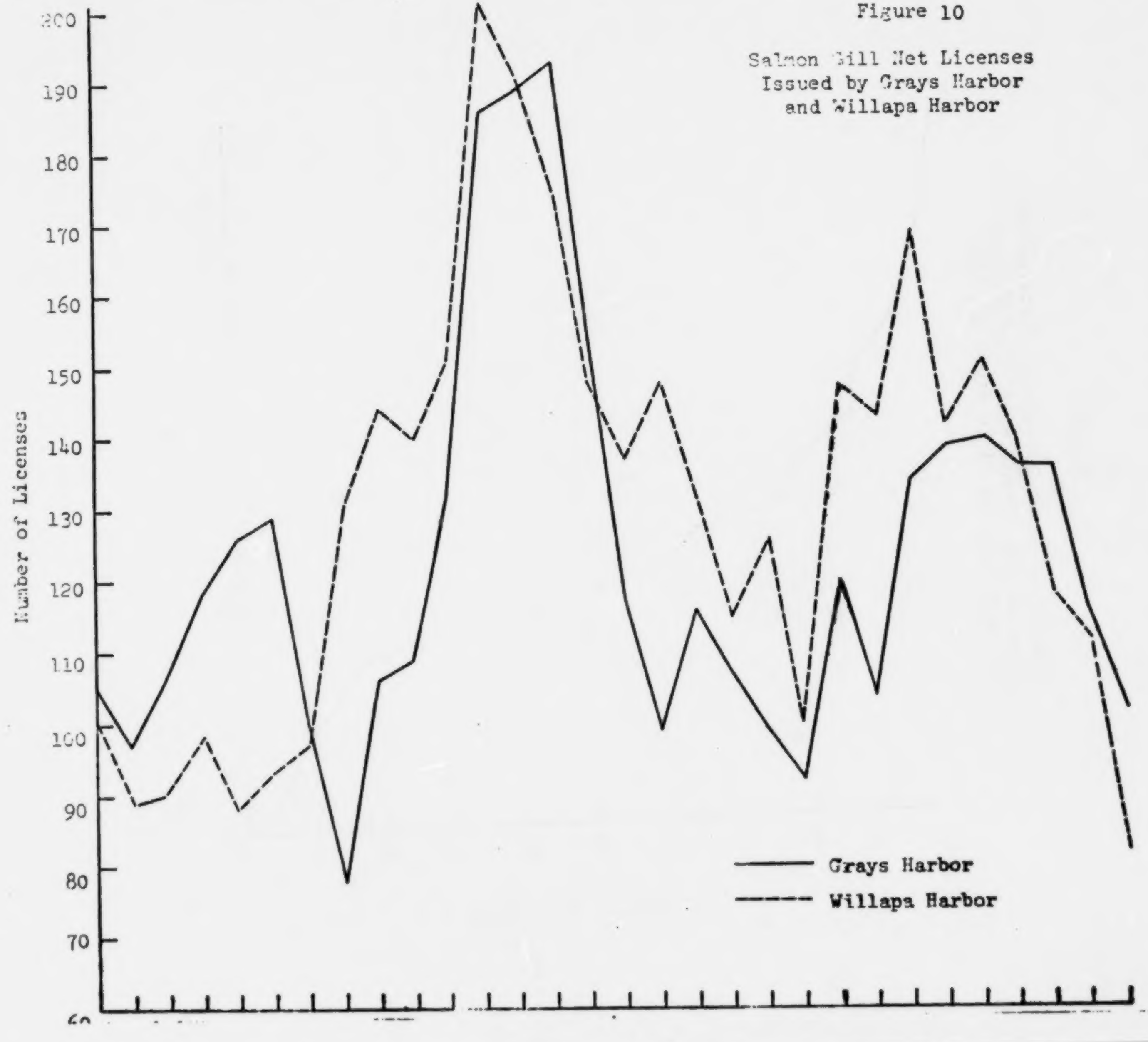


Figure 10

Salmon Gill Net Licenses
Issued by Grays Harbor
and Willapa Harbor



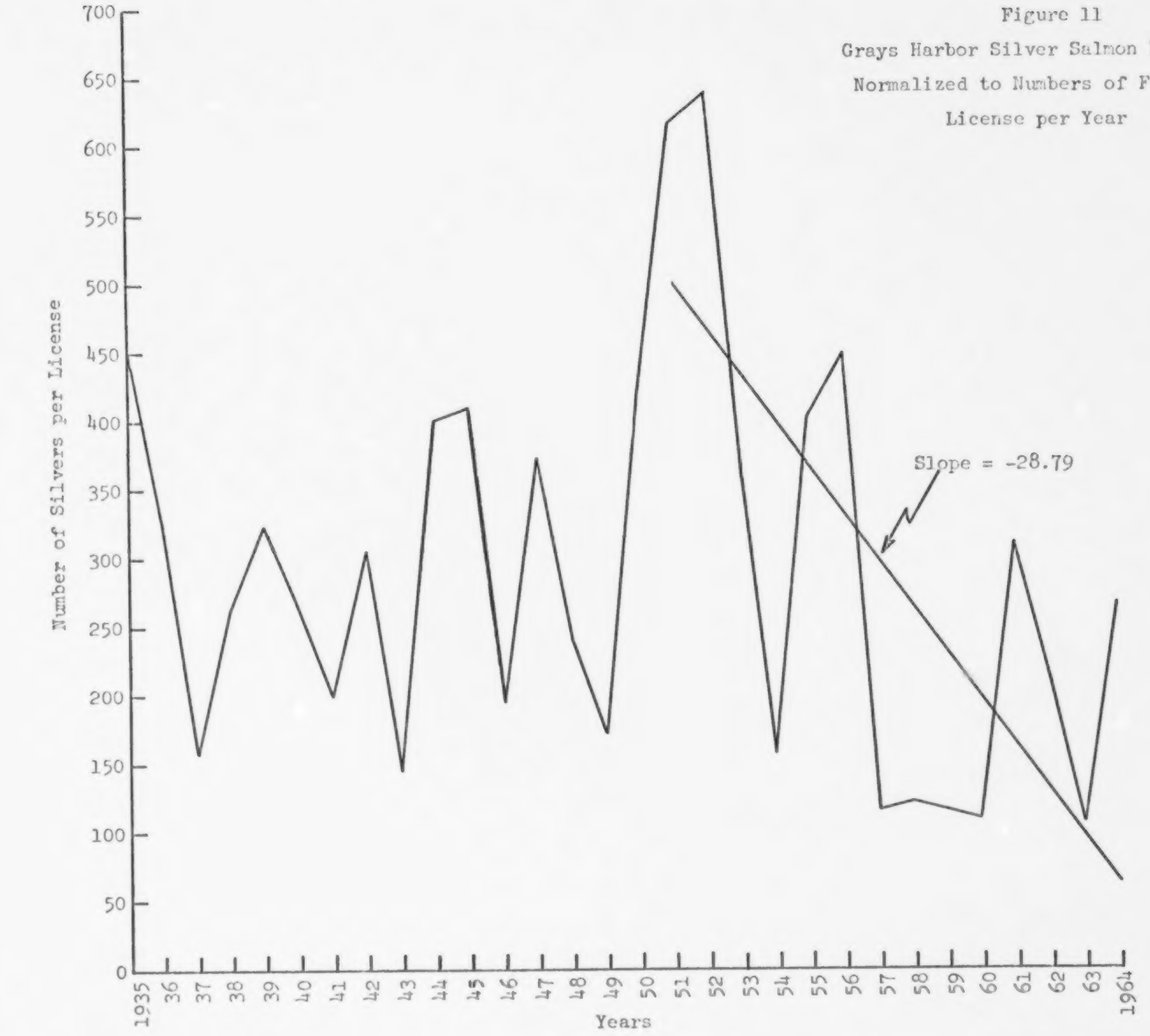


Figure 11
Grays Harbor Silver Salmon Landings
Normalized to Numbers of Fish per
License per Year

Figure 12

Willapa Harbor Silver Salmon Landings
Normalized to Numbers of Fish per License
per Year

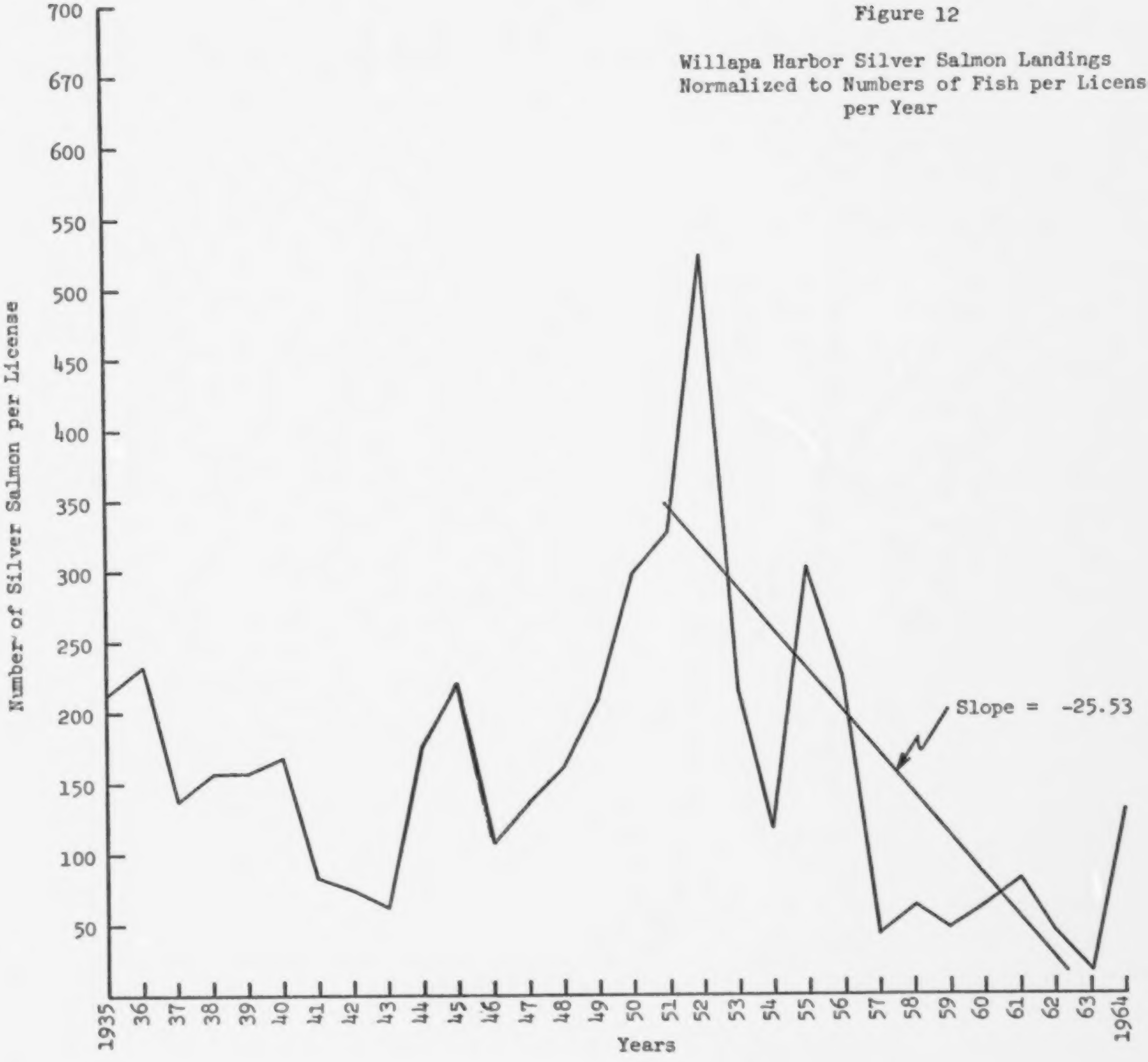


Figure 13

Grays Harbor Chum Salmon Landings
Normalized to Numbers of Fish
per License per Year

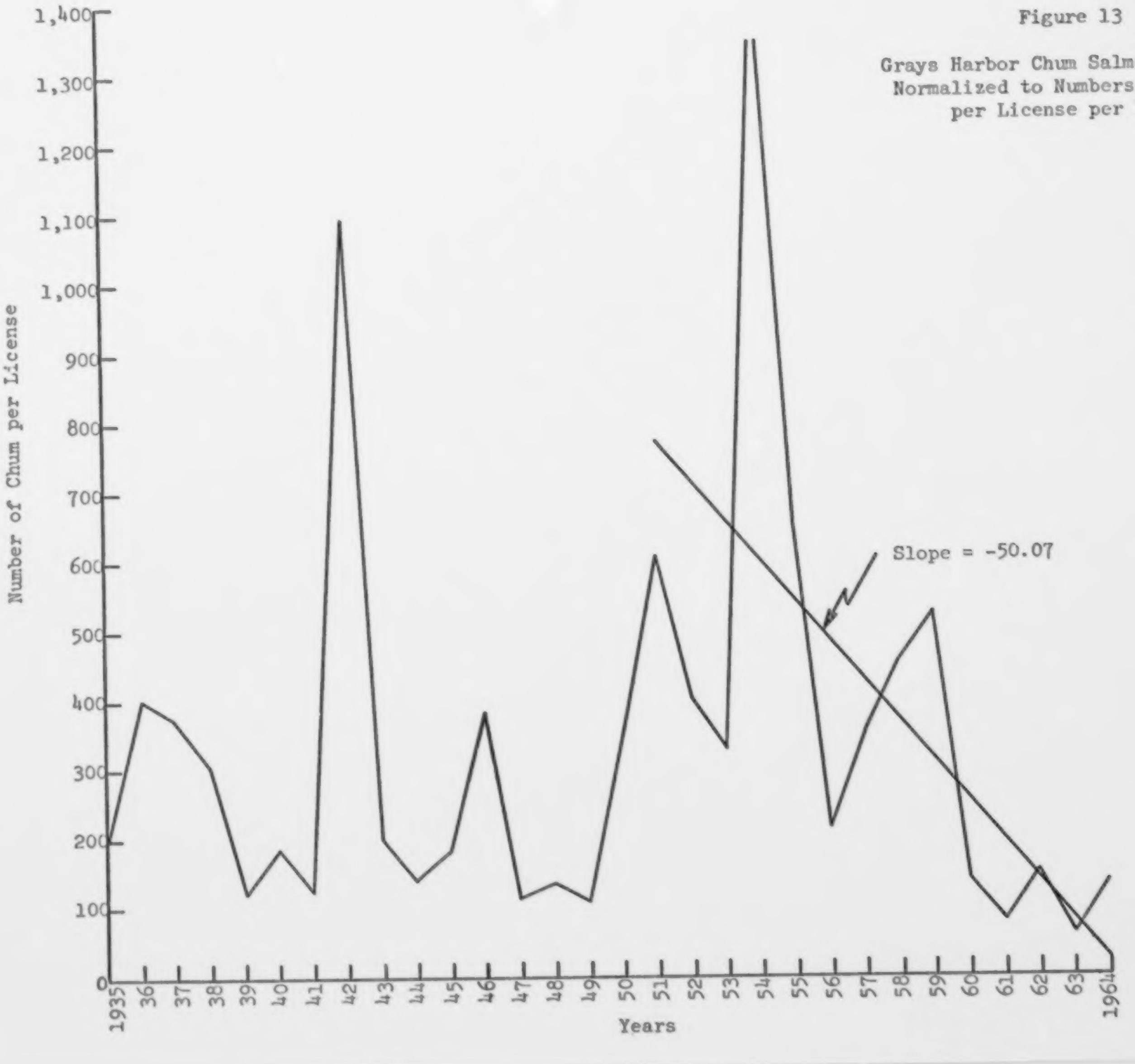
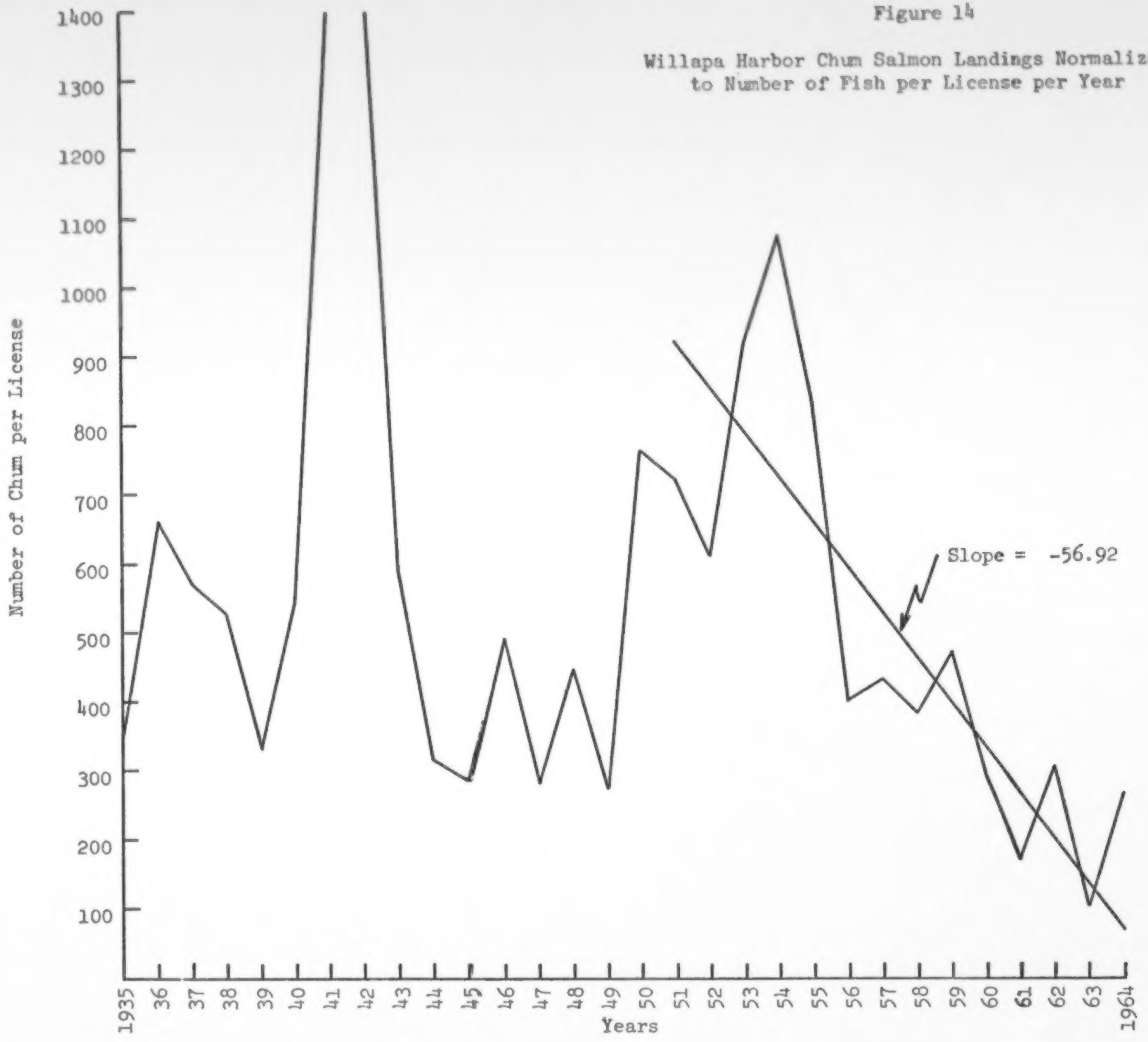


Figure 14

Willapa Harbor Chum Salmon Landings Normalized to Number of Fish per License per Year



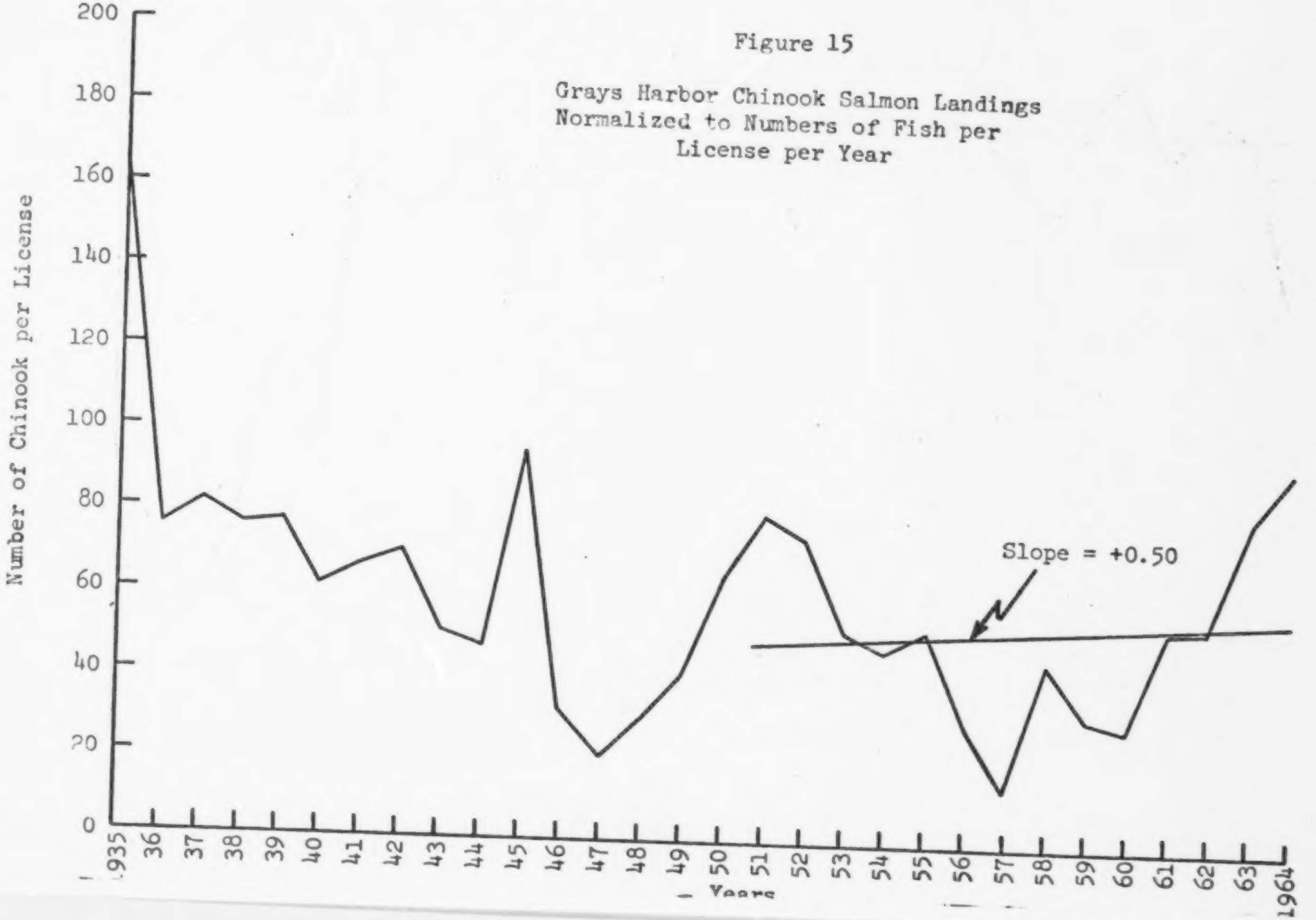


Figure 15

Grays Harbor Chinook Salmon Landings
Normalized to Numbers of Fish per
License per Year

Figure 16

Willapa Harbor Chinook Salmon Landings Normalized to Numbers of Fish per License per Year

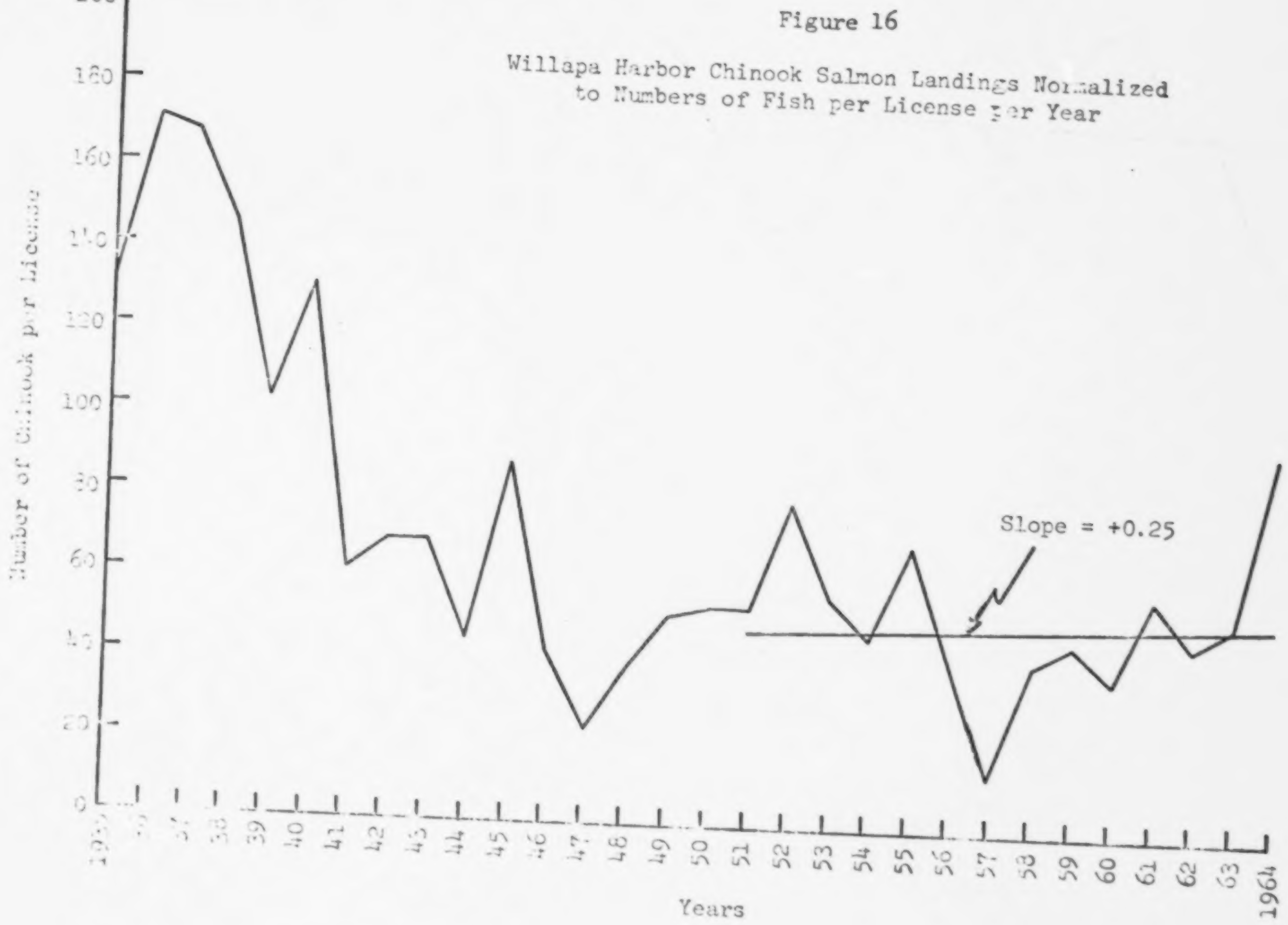


Figure 17

Pacific Oyster Landings in
Gallons x 10^{-3}
for
Grays Harbor

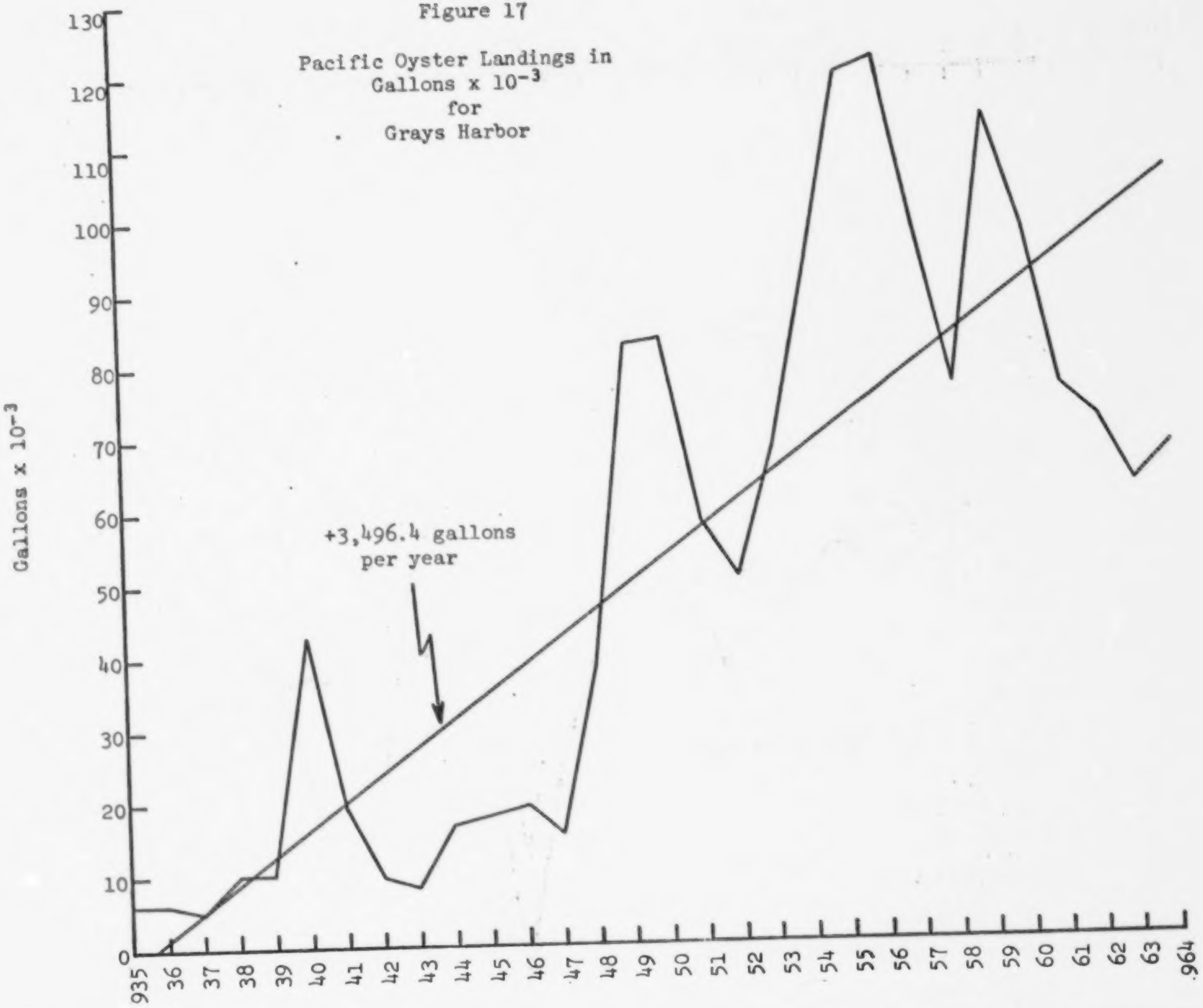
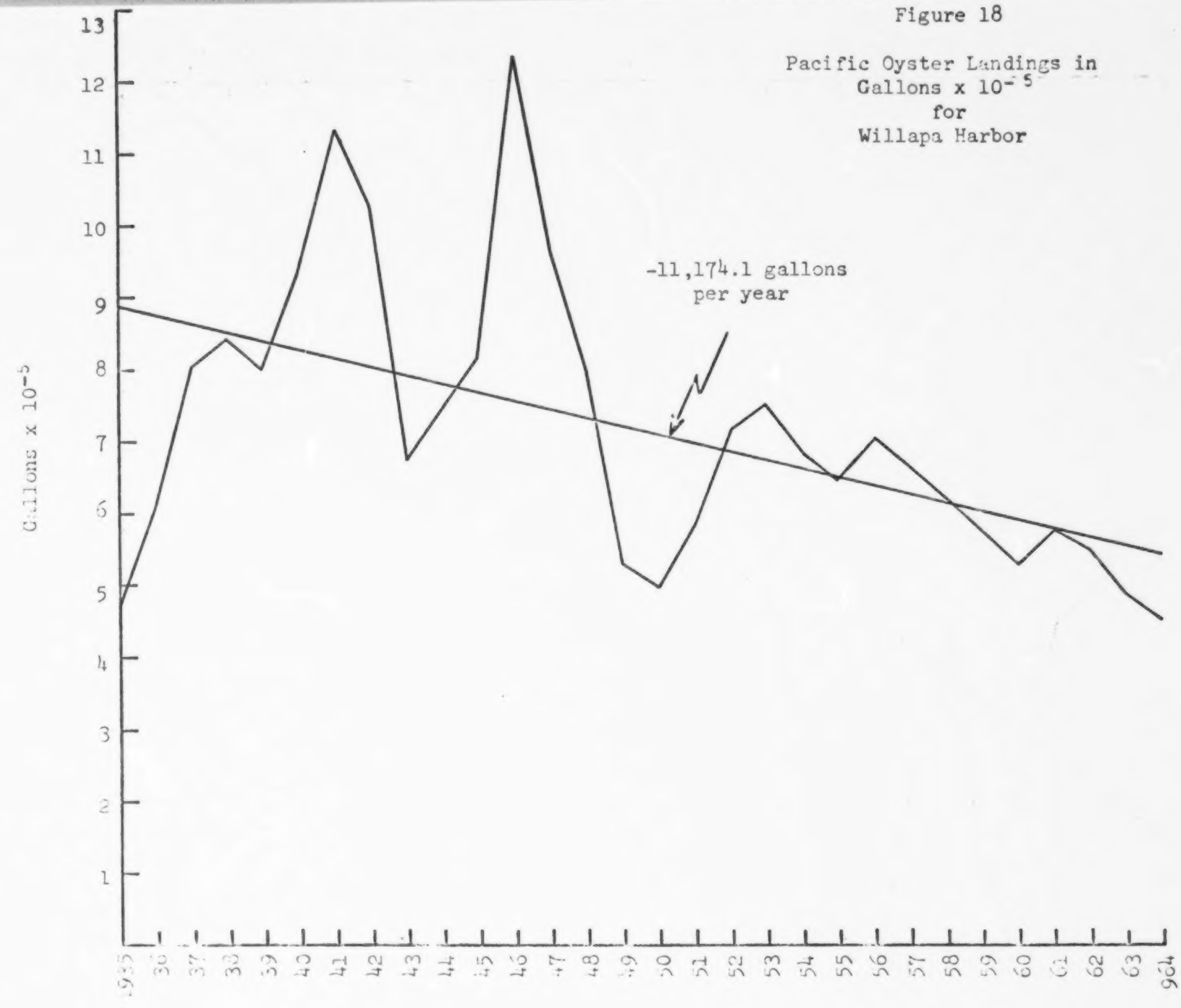


Figure 18

Pacific Oyster Landings in
Gallons x 10^{-5}
for
Willapa Harbor



ITT RAYONIER
INCORPORATED
OLYMPIC RESEARCH DIVISION
REPORT

APPENDIX B

Date: February 2, 1967 **No.** G 10:1-5

Prepared by: J. E. Stein and J. G. Denison

Subject: GRAYS HARBOR WATER QUALITY AND COMPATIBILITY OF USES

ABSTRACT: Water quality and water uses in the Grays Harbor estuary were evaluated. One goal was to ascertain if the various uses were compatible and another goal was to suggest water quality standards, mainly dissolved oxygen concentration, for the waste dispersal and assimilation zone. An average of 4 parts per million (ppm) with a minimum of 3 ppm of dissolved oxygen (DO) was suggested for the dispersal and assimilation zone. It was found that present uses were compatible.

INTRODUCTION

The Federal Water Quality Act of 1965 has focused national attention on the quality of the aquatic environment. Essentially, the Act requires each state to formulate water quality standards and plans for implementation of the standards. The Act also stipulates that if the states do not set appropriate standards on interstate and navigable waters, the Federal Water Pollution Control Administration (FWPCA) will intervene and set the standards. Furthermore, if the FWPCA intervenes, it will then administer the program. In setting the standards, the Water Quality Act stipulates that the uses of the waters must be considered. It appears that the important task is to maximize the use and, at the same time, enhance the quality of the resource. The ultimate goal is that man must realize maximum benefits from the water resource.

For the purpose of realizing maximum benefits, provisions must be made for as many different uses as possible; however, these multiple uses must be compatible or made compatible with one another. In some cases, only a few uses may be allowed to occur simultaneously on the same body of water. For example, setting aside a stream for salmon spawning will restrict it from many other uses. Spawning areas require a quality of water that should have, among other things, high levels of oxygen concentration and should be free from silt and toxic materials. However, in most places, especially in estuaries, limitations are not as restrictive and greater multiple use can be practiced. The purpose of this report is to describe the water quality of Grays Harbor and to ascertain if the many uses of the Harbor are compatible with one another.

METHODS AND PROCEDURES

Routine biological, chemical and oceanographic procedures of sampling and analysis were used.[1,2] All fish landing statistics were from statistical reports of the Washington State Department of Fisheries.[3] The source of other pertinent information is cited at the appropriate place in the text and listed in the bibliography.

Geography

Grays Harbor is located on the west coast of the State of Washington. Hoquiam, Aberdeen, Montesano, Cosmopolis and Westport are the major cities in the area (Fig. 1). The economy of this area is primarily based on wood products. In addition to this major industry, a gill net fishery exists in the Harbor, much of it occurring in the North Channel at the inlet near the City of Hoquiam. An oyster industry exists at the more westerly portion of the Harbor in North Bay and South Bay (Fig. 1). Also located on the North Channel of Grays Harbor is a newly constructed fish rendering plant which uses hake, considered as a trash fish on the West Coast, as raw material for the manufacture of fish flour.

Besides the many sawmills, shake mills and plywood mills, there are two pulp mills and one paper mill in the area. The pulp mill in Cosmopolis is owned by Weyerhaeuser Company and the one in Hoquiam is operated by Rayonier Incorporated (Fig. 1). In addition to manufacturing chemical cellulose, the Rayonier mill also furnishes fiber to the Grays Harbor Paper Company which is located in the same industrial complex as the Rayonier mill.

It is assumed that in the future more industries will be located in the Harbor as new raw materials are utilized more efficiently. Most, if not all, of these industries will use the waters of Grays Harbor in some way or another. Consequently, when formulating water quality standards, present and future uses must be considered.

Geomorphology

The Grays Harbor estuary may be considered as starting at Montesano on the Chehalis River. The Chehalis River follows a meandering course to its inlet into Grays Harbor in the vicinity of Aberdeen. During low flow periods of less than 600 to 700 cubic feet per second (cfs), salt water in the river intrudes as far east as the city of Montesano. Approximately six miles east of Montesano, the Satsop River is tributary to the Chehalis River system. Further to the west, the Wynoochee River enters the Chehalis River near the city of Montesano. The confluence of the Chehalis and the Wishkah Rivers occur at Aberdeen. Continuing in a westerly direction, the Hoquiam River enters Grays Harbor at the city of Hoquiam. At the most western part of the Harbor, the Humptulips River enters at North Bay and the Elk and Johns Rivers at South Bay (Fig. 1).

Grays Harbor estuary is triangular in shape with the inlet of the Chehalis River at the apex in the eastern portion. The mouth of the Harbor is at the base of the triangle at its western end. From Aberdeen to its mouth, the estuary is 14.52 miles long. The widest portion in the north-south direction is 14.20 miles (Fig. 2).

Geologically, the estuary is classified as a drowned river mouth. Historically, the mouth of the river was drowned by the sea; gradually the silt load carried by the river buffered the erosional action of ocean waves and currents with the resultant formation of sand bars and shoal water. Coastal currents also formed depositional features such as spits and bay-mouth bars which further restricted the entrance of the estuary. The decreased size of the estuary entrance restricted the flow of water in the upper reaches. As the water velocities decreased, the suspended silt load settled and formed extensive tide flats and sand bars.[4] All of these processes are currently taking place in Grays Harbor. In fact, the geological characteristics of Grays Harbor are typical of a "pure" estuary of the drowned river-mouth classification. The constant deposition of silt requires an active dredging program to maintain the channels for navigation purposes. If the channels were not dredged, oceangoing vessels would not be able to navigate the Harbor.

Dynamics

From a dynamic point of view, or in terms of an oceanographic classification, Grays Harbor is classified as a positive estuary. In a positive estuary, the inflow of fresh water from precipitation and runoff exceeds the loss of fresh water by evaporation. In this system, salinity is generally at or near zero, depending upon tide, in the river and progressively becomes more saline toward the mouth of the Harbor (Fig. 3). In a positive estuary, the fresh water input plays a significant role in the length of time waste material stays in the Harbor. This time interval is called the flushing rate or residence time. It is an average figure and represents the time fresh water or a waste effluent would remain in the estuary.

Figure 4 shows the increase in volume of the Grays Harbor system from Montesano to the Harbor entrance. The two curves shown in this figure represents the mean lower low tide and mean higher high tide volumes. At mean lower low tide, the volume of water from Montesano to the Harbor mouth is 102.21 billion gallons. At mean higher high tide the volume is 277.79 billion gallons, or nearly three times that of the water volume at mean lower low tide. At low tides, there are many exposed sand bars and extensive shoal waters which makes navigation outside the dredged channels extremely dangerous (Fig. 1). It is for this reason that water skiing and boating are not popular recreational sports in the Grays Harbor area. The shallowness of the area is brought out by a comparison of average low and high tide depths. In this comparison the low tide water volume is divided by the low tide surface water area to obtain an average low tide depth. The average high tide depth was computed in a similar manner. When depths are thus computed, it is found that the average depth at the lower tide is 12.6 feet and the higher tide average depth is 14.3 feet, or only 1.7 feet higher than the low tide depth. This slight difference is easily explained. At low tide, the extensive sand bars and tide flats considerably reduce the area of surface water to the deeper channels. This creates a relatively high water volume to surface area ratio. At high tide, the water covers the sand bars and tide flats resulting in a considerable increase in the surface area of water. However, the total volume of water at high tide is not sufficient to cover these tide flats to any great depth; in many places it is only a few feet deep. At mean higher high tide, the surface of the water area is approximately two and one-half times the surface area at mean lower low tide while the water volume is only two and eight-tenths times greater than the low tide volume. Consequently, the change in the volume to surface area ratio is not great enough to cause a large increase in the average depth at mean higher high tide. The fact that the average depth at the lower tide is only 1.7 feet less than that at the higher tide emphasizes the extensiveness of the tide flats within the Harbor. The surface area of exposed mud flats in Grays Harbor is 52.8 square miles during each mean lower low tide. This factor, in conjunction with the relative shallowness at high tide, points to the necessity for a constant dredging program.

Flushing

The quality of receiving waters is substantially affected by the length of time a waste remains in an area. Biochemical oxygen demand (BOD) is a time-concentration phenomenon; thus, for a given concentration of waste, any increase in length of residence time will exert an increase in oxygen consumption.

The classical approach used by oceanographers and engineers in measuring residence time depends upon the following assumptions:

(1) Entering sea water mixes completely and uniformly with a waste present in the estuary at low tide.

(2) The volume of sea water and mixed waste move seaward on the ebb tide and no portion is returned to the area on the next flood tide.

(3) The proportion of waste removed during the ebb tide is equal to the proportion of accumulated fresh water removed.

Investigations by Ketchum[5] have demonstrated that, in actual field conditions, the first two assumptions are not true. Furthermore, most theoretical approaches assume an accurate knowledge of the amount of river flow or fresh water entering the estuary during each tidal cycle. In a complex system such as Grays Harbor, the total volume of fresh water entering the estuary is not known. In this system, the influx of fresh water from the Chehalis River may be significantly augmented by underground water as well as other surface streams. Consequently, the exchange ratio, i.e., the amount of fresh water removed each day to the total amount that is accumulated, cannot be accurately determined. Unfortunately, an accurate determination of the exchange ratio is essential because the reciprocal of this figure represents the residence time or flushing rate.

Owing to the complexity of the estuary and the inability to accurately determine the amount of fresh water entering the estuary each day, the flushing rate was empirically approximated.

On or about November 11, 1964, the Rayonier and Weyerhaeuser mills at Grays Harbor started to close down. By November 18, 1964, all effluent discharges ceased. On November 12, 1964, impounded spent sulfite liquor (SSL) from Rennie Island was released at the rate of 1,700 gallons per minute. The discharge of SSL was discontinued on the morning of November 18, 1964. The released liquor served as a source of Pearl-Benson, Positive Material (PBPM). On November 19, 1964 at 10:15 p.m., a continuous sampling program was started. Samples were taken approximately 18 feet below the surface at mean sea level by a continuous water sampler. The location of the continuous sampler is shown in Figure 5. Figure 6 shows its location relative to the shoreline. The samples were analyzed for PBPM using the method of Goldschmid and Maranville.[6] The results are given in Table I.

Over the duration of the study, it was assumed that the decrease in the Pearl-Benson Index (PBI) was largely due to the effect of river flow and tidal action. The effect of biological decay was assumed to be negligible over the period of observation.

In developing an equation to express the amount of PBPM removed (Cr) at time (t), it is assumed that a constant proportion (P) of the amount present at the start (C_o) is removed with each ebb tide. At the end of the first day, the amount removed (Cr_1) is

$$Cr_1 = CoP. \qquad \text{I}$$

The amount remaining at the end of the first day (Ct_1) is

$$Ct_1 = Co - CoP = Co\ (1-P). \qquad \text{II}$$

On the second day the amount removed (Cr_2) is

$$Cr_2 = CoP\ (1-P), \qquad \text{III}$$

and the amount remaining (Ct_2) becomes

$$Ct_2 = Co\ (1-P) - CoP\ (1-P) = (Co - CoP)\ (1-P) = Co\ (1-P)^2$$

Letting A = (1-P), then the amount removed on the second day (Cr_2) becomes

$$Cr_2 = CoP\ (A), \qquad \text{IV}$$

and the amount remaining (Ct_2) is

$$Ct_2 = Co\ (A)^2. \qquad \text{V}$$

Table II summarized the analysis for a five-day period. From this table, it can be seen that the general expression for the amount of waste remaining (Ct) after any day (t) is

$$Ct = Co\ (A)^t. \qquad \text{VI}$$

Also from Table II, it can be seen that the general expression for the amount of waste removed at any given time (t) is

$$Cr = CoP\ (A)^{t-1}. \qquad \text{VII}$$

If Equation VI is converted to the log form

$$\ln Ct = \ln Co + \ln A\ (t), \qquad \text{IX}$$

a straight line function is generated. Figure 7 is a graph showing the regression line of Equation IX for the data in Table I. In this figure, (ln A) is the expression for the slope of the best fit line. After (A) is computed, the proportion of waste removed (P) may be calculated from the relationship

$$A = (1-P).$$

In this evaluation, the slope of the line (lnA) is an average value generated from hourly data; consequently, the proportion removed is also on an hourly basis. The average proportion removed per hour was found to be 0.00759. In converting this to a daily basis, the proportion of the remaining material removed each day is 0.191 or 19.1 percent.

During the survey period, stations shown in Figure 6 were sampled for PBPM at low tide on November 20 and 24. Applying the equation,

$$Ct = Co\ (A)^t = Co\ (1-P)^t,$$

the remaining PBI was predicted for four different stations after five days of flushing. The comparisons are shown in Table III. All computations were based on a P value of 0.191, heretofore discussed, and the initial concentration (Co) observed at each respective station on day 1 (i.e., November 20). It can be seen that a fairly close agreement occurred. From these data, it is concluded that every 24 hours, under river flow conditions of 2,731 cfs (the flow prevailing during the survey), approximately 19.1 percent of the waste material is removed. The proportion removed (0.191) is considered as an exchange ratio (r_n). The reciprocal of the exchange ratio is the residence time (Rt). On the basis of the foregoing data, the residence time, in days, for Grays Harbor is

$$Rt = \frac{1}{r_n} = \frac{1}{0.191} = 5.91$$

It should be cautioned that this approach is only a crude, first approximation of the flushing rate. The approach is vastly oversimplified. If the data were developed on the basis of actual mass of PBPM, a value closer to the true figure would be obtained. Callaway, using a tidal excursion prism approach, found the flushing rate to be 5.1 days at a river flow of 700 cfs. Consequently, our approximation is definitely on the conservative side. In any case, once it is agreed that the residence time is in excess of five days, any further discussion becomes academic. At a residence time of five days or more, most, if not all, of the waste will be assimilated within the harbor. This appears to be the situation in Grays Harbor, especially in the easterly portion.

In the western portion of the Harbor, flushing conditions are more rapid. According to Figure 4, at a location approximately nine miles downstream from Rayonier's mill, a large proportion of the waste would leave the Harbor on a single ebb tide. The rapid flushing rate in this area is of considerable biological importance and will be discussed in the section dealing with shellfish culture.

Dissolved Oxygen

One of the important water quality parameters is the amount of dissolved oxygen available to the biota of the receiving environment. Oxygen is needed for the survival of the aquatic community. Bottom dwelling fish require less oxygen for their survival than those living at mid-depths or near the surface. Salmon require higher concentrations of oxygen than flatfish; on the other hand, certain commercially important invertebrates, such as oysters, require little or no oxygen. The Pacific oyster is an example of the latter situation. This mollusk is an intertidal organism that is frequently found out of the water during low tides. During this exposure, little oxygen, if any, is available to them. Because of their low demand, these oysters can withstand long periods of exposure to low oxygen environments. Moreover, even the very young Pacific oysters, or spat, can withstand transpacific shipment on the decks of vessels. Locally, adult oysters are frequently shipped overland from one bay to another without ill effects other than mechanical shell damage resulting from rough handling. Consequently, it is concluded that in nonspawning oyster areas, the oxygen concentrations are not as important as they are for finfish survival.

Finfish such as salmon require a higher level of dissolved oxygen than do shellfish; however, this does not mean that finfish are unable to withstand extreme low levels of oxygen for short periods of time.

Lawrence D. Townsend,[8] et al. carried out a series of experiments to ascertain the lowest oxygen levels at which salmonids could survive. They found that silver fingerlings weighing three to four grams cannot tolerate DO levels below 1.25 parts per million (ppm). For yearling steelhead trout, they found the minimum tolerance level to be 1.50 ppm of DO. For cutthroat trout, the minimum tolerance was 1.40 ppm.

Doudoroff and Shumway,[9] in an excellent paper on the DO requirement of fish, showed that, for newly hatched fish and underyearlings, levels of oxygen in excess of 5 ppm are needed for good growth and development. However, they also point out that "concentrations not much below 2 ppm probably can be tolerated for long periods by most fishes at temperatures that are not unusually high, and many species can live at concentrations near and below 1 ppm". Stein, et al.[10] found that salmon fingerlings can be kept at 2 ppm for many days. In their experiment, chinook fingerlings were kept at 2, 3 and 10 ppm of DO for 40 days, after an acclimation period of 8 days to adjust the fish to lower oxygen levels. No deaths occurred, and weight gains for the fish kept at 3 and 10 ppm of DO were not significantly different. The fish kept at 2 ppm of DO gained less weight than those maintained at 3 and 10 ppm. It is concluded that oxygen values of 3 ppm will not cause the death of fish nor substantially affect their physiology as measured by changes in body weight. It is important to note that these conclusions are based on laboratory experiments which are "unnatural" in their environmental aspects and involve adverse physiological stresses not normally found in the field. Consequently, a minimun standard of 3 ppm for a fish passage zone in an industrial area, where fish are only in residence for a short period of time, would be a conservative standard for minimum oxygen concentrations. It also is concluded that 4 ppm for "feeder" salmon and adult fish will not cause any deaths or exert any recognized or apparent deleterious effect for periods lasting a month or less. It is therefore concluded that an average of 4 ppm with a minimum of 3 ppm would be an appropriate standard for a fish passage area receiving wastes that exert an oxygen demand but are not present at toxic concentrations.

These conclusions are in line with the suggestion by Ellis[11] that a "good fish fauna" (defined as including such representatives of the finfish group as trout and salmon) should have a DO concentration of 4 ppm or over.

Source of Oxygen in the Harbor

During the flood tide extending from mean lower low water to mean higher high water, approximately 170 billion gallons of water enter the Harbor. If the incoming water had an oxygen concentration of 7 ppm, the total amount of oxygen added to the Harbor would be 10.2 million pounds. At a winter river flow of 20,000 cfs and 7 ppm of DO, the oxygen contribution from the river during a six-hour period would only be about 188,601 pounds. The river input is not sufficient to assimilate the waste being discharged during either the winter or summer months. In winter months, Rayonier alone discharges in the excess of 300,000 pounds of 5-day BOD per day; nevertheless, the oxygen concentrations within the Harbor are in excess of 5 and 6 ppm. Consequently, it is concluded that the major oxygen input is from the ocean and not the river.

It is further concluded that the primary effect of the river is to increase the flushing rate. In any given cell with the Harbor, the exchange ratio (r_n) is:

$$r_n = \frac{Pn}{Pn + Vn} = Pn \frac{1}{(Pn + Vn)} \qquad \text{(A)}$$

where Pn is the intertidal volume and Vn is the low tide volume.

Assuming that Vn is constant, Pn will vary as a function of river flow (R). The intertidal volume may be expressed as,

$$Pn = R + V_h. \quad (V_h \text{ is the high tide increment}) \qquad \text{(B)}$$

Substituting Equation B for Pn in Equation A, the exchange ratio becomes

$$r_n = (R + V_h)\frac{1}{(R + V_h + V_n)}. \qquad \text{(C)}$$

Since the high tide volume and the low tide volume are relatively constant, let $V_h + V_n = K$. Substituting K into Equation C, the exchange ratio becomes,

$$r_n = (R + V_h)\left(\frac{1}{R + K}\right). \qquad \text{(D)}$$

Taking the limits of Equation D

$$\lim_{R \longrightarrow +\infty} r_n = (R + V_h)\left(\frac{1}{R + K}\right) = +\infty, \qquad \text{(E)}$$

it is seen that the exchange ratio becomes infinitely large. The retention time (R_t) is

$$R_t = \frac{1}{r_n}. \qquad \text{(F)}$$

As r_n becomes increasingly large, the retention time becomes progressively smaller. Consequently, the winter river flows decrease the retention time of waste in the Harbor, and thereby cause in increased oxygen levels.

It is therefore concluded that the higher winter oxygen levels are primarily the result of increased flushing rates or decreased retention times.

During the summer, river flows are usually less than 4,000 cfs. Figure 8 is a typical hydrograph for the Chehalis River during the summer period. Figure 9 compares three summers in the form of frequency cumulation curves. The curves for 1964, 1965 and 1966 represent the low summer flow conditions. The summers of 1965 and 1966 represent the lower flow conditions and 1964 the upper range of flows. In August and September of 1965, the average flow was 694.59 cfs; for the same months in 1966, the average flow was 623.56 cfs. The median flows for 1965 and 1966 were approximately 500 cfs. At these low flows only about 6,500 pounds of oxygen would be introduced, during a six-hour period, into the inlet by a river water having a concentration of 7 ppm of DO. In contrast, the oxygen input from the ocean is over fifteen hundred times that contributed by the river during the August - September period.

An evaluation of oxygen deficit also reveals that the major source of oxygen is from the ocean. The oxygen deficit is the difference between the observed oxygen and the oxygen concentration at saturation. The use of the oxygen deficit concept allows for comparisons which are independent of salinity and temperature. In Figure 10, the oxygen deficit and chlorinity are compared. Note that the rise and fall in the deficit is closely correlated to the chlorinity, i.e., as the chlorinity increases the oxygen deficit decreases.

During long summer tidal run-outs, the extensive mud flats are exposed to the warming action of the sun; as a result, the temperature of the water coming in over these tide flats increases. With an increase in temperature, the amount of DO decreases. In addition, the rate of BOD also increases, tending to lower the oxygen even further. During the longer tidal run-outs, bottom sediments are brought into suspension by turbulence. This brings some of the bottom organics into an aerobic environment thereby exerting another oxygen demand which is not extant during the more "normal" tides. Figure 11 graphically shows the relation between tidal run-out and oxygen deficit. From this figure, it will be noted that with the larger tidal run-outs, there is a greater oxygen deficit. It should also be noted that with the shorter run-out, chlorinities remain higher and oxygen concentrations, as heretofore mentioned, would also be higher.

Another phenomenon which tends to decrease the oxygen concentration within the Harbor is upwelling. During periods of sustained northerly winds, surface waters are transported away from the coast and are replaced by deep oceanic water having lower temperatures and considerably lower dissolved oxygen. This water is then brought into the Grays Harbor estuary by the incoming tide. Pearson and Holt[12] found that oceanic waters having DO concentrations as low as 1 and 2 ppm have, at times, penetrated the Harbor. Upwelling generally occurs during the summer when river flows and the resultant oxygen contribution from the river are relatively low. It is concluded that in any water quality management program, river flows, BOD discharge, tidal run-out, and upwelling must be seriously considered. Wind direction and water temperature measurements at Westport would be helpful in predicting the probable occurrence of upwelling. Such measurements should become an integral part of any management program.

During periods of low river flow (less than 3,000 cfs) in the Chehalis River, weekly survey trips are conducted (Fig. 12). When the flow decreases to 1,000 cfs, or less, the stations shown in Figure 13 are visited on a daily basis. Each trip starts at, or near, low slack tide at Station 52.

In the summer months, an oxygen sag occurs in the North Channel, as shown in Figure 14. During minus tides, the lowest DO concentrations, or sag point, is generally found in the vicinity of Moon Island. The minimum values, observed at low tide, move in an easterly direction with the incoming water and may be found as far east as the Standard Oil Dock (Fig. 1). From observations of oxygen concentrations at the stations shown in Figure 12, it is concluded that the waste dispersal and assimilation zone extends from Stations 44 to 54. At mean lower low tide the volume of water within this segment of the Harbor is 1.52 billion cubic feet or 11.1 percent of the total water volume of the Harbor at mean lower low tide. The other 88.9 percent of the Harbor is, for all practical purposes, unaffected by industrial discharge. Generally, the lower low tide volume of water having the lowest oxygen values, as represented by the block of water in which Stations 52, 53 and 58 are found, is 0.34 billion cubic feet. This represents only 2.7 percent of the total lower low water volume in Grays Harbor. Figure 15 shows a cumulative frequency curve of oxygen concentrations occurring at these three stations during the months of August and September of 1966. From this figure, it can be seen that the oxygen values at Station 52 were below 5 ppm about 86.7 percent of the time, below 4 ppm approximately 44.5 percent of the time and below 3 ppm 1.7 percent of the time. For Station 53, the oxygen values were below 5 ppm approximately 77.7 percent of the time, below 4 ppm approximately 50.6 percent of the time and below 3 ppm 2.4 percent of the time. For Station 58, the oxygen values were below 5 ppm 67.4 percent of the time, below 4 ppm 38.2 percent of the time and below 3 ppm 3.5 percent of the time. During this period, the Chehalis River flow was below 1,000 cfs 98 percent of the time and below 500 cfs 38 percent of the time, as can be seen in Figure 9.

BOD Discharge - Abatement Facilities

The Rayonier and Weyerhaeuser mills, located at Grays Harbor, discharge most of the BOD loading into the estuary. The Weyerhaeuser mill commenced operations in 1957. It is a new mill using the MgO process. Part of this process is to burn the organics of cooking liquors and to recover the inorganics for further use. In 1965 they started to treat other organic wastes in an aerated lagoon. The residual organics from the lagoons and untreated portions of the mill waste is discharged into the Harbor. Rayonier, using a sodium-base cook, burn their cooking liquors in a newly built recovery furnace and stores unburnt liquors, as well as some bleach plant waste, in a large lagoon on Rennie Island. Storage capacity of this lagoon is sufficient to last through the low river flow periods.

In the 1930's, oxygen concentrations sufficiently low enough to cause frequent fish kills occurred (Eriksen and Townsend op. cit.). Consequently, a series of experiments were carried out in an attempt to treat the wastes from the Rayonier mill. Dr. T. G. Tyler, a sanitary engineer and Dean of the University of Washington Engineering College, experimented with trickling filters and concluded that this method of treatment would be impractical. In 1942, a lagoon in which wastes could be stored during low flow periods, was built on Rennie Island. The cost of the initial lagoon construction was $107,000. Also at this time, a water quality monitoring program was instituted and is still carried out to this day. Data from the water surveys are routinely submitted to the Washington State Pollution Control Commission (PCC). In 1946, the pipeline to Rennie Island was rebuilt at a cost of $46,900. Five years later, construction almost doubled the size of the lagoon at a cost of $234,800. Also during this period, the main sewer was extended and submerged, upon mutual agreement of Rayonier management and the PCC, at a cost of $55,400. Prior to 1951, some of the SO_2 removed from blow gases was sewered. In 1951, cooling equipment and storage tanks, costing $84,200 were installed so that condensing water containing the SO_2 could be recirculated into the showers. In this manner, water containing SO_2 was diverted from the Harbor. In the 1953-1954 period, blow pits and washing systems were modified so that the more concentrated wastes could be stored in the lagoon. This further decreased the discharge of organics into the receiving waters. The cost of these modifications was $61,000. Following this period, additional modifications of blow pit drains were made in addition to installing a weak liquor washing system. This allowed for even more organic wastes to be discharged to the lagoon. In 1954, the Rennie Island pipeline was replaced at a cost of $66,700.

In 1956, various types of collecting and screening devices were installed, at a cost of $191,000, to prevent the loss of fibers, knots and slivers to the estuary. In 1957, $40,600 were spent to renew the Rennie Island lagoon sewer system. In 1958, several sewers were combined, at a cost of $22,000, for the purpose of submerging outfalls and improving inplant monitoring. In 1960, $7,200 were expended to improve drainage control of the lagoon. In addition, $46,900 were spent for the separation of sanitary and industrial waste. This allowed for the diversion of sanitary wastes to the Hoquiam sewage treatment plant. In 1962, Rayonier started the new sodium recovery system which cost $7,450,000. Also in 1962, a full-time professional engineer was placed in charge of the water quality protection program. From 1962-1965, development cost of the new recovery system amounted to $951,000. In 1963, Rayonier spent $21,000 for a metering and alarm system to serve as a warning in the event of a pipeline failure to Rennie Island. In 1964, sewer samplers were rebuilt at a cost of $4,000. Also during this period, the pipeline to Rennie Island was replaced with a double enclosed stainless steel pipe at a cost of $134,000. In 1964-1965, Rayonier spent $1,085,000 so that more wastes could be manufactured into useful silvichemicals and thereby decrease waste loadings into the Harbor. In the same year, $1,204,000 was spent on a pulp-washing and liquor-recycle system. This system facilitated the concentration of wastes going to Rennie Island, thereby indirectly allowing for more storage capacity in the lagoon. In addition to the foregoing improvements, $122,000 was spent in 1965 to concentrate bleach plant wastes and to enable them to be pumped to Rennie Island.

In 1966, Rayonier spent $600,000 on the sodium recovery systems in order to provide for a more efficient operation. These provisions allowed for the burning of more wastes. Table IV lists the cost of water monitoring from 1961 to 1966 and Table V summarizes the type of abatement cost, and purpose.

Receiving Water Dissolved Oxygen

From the preceding history on water protection, it can be seen that considerable thought, time and money has been expended on environmental control. The results of these efforts are manifested by the progressive improvement in water quality as shown in Table VI. For the purpose of comparison, three stations were selected: one is located in the vicinity of the oxygen sag (Sta. 53); another is immediately adjacent to the Rayonier mill (Sta. 52); and the third is located in the Hoquiam River (Sta. 34). Figure 13 shows the locations of these stations. The data from which Table VI was prepared includes all of the water samples obtained (inclusive of each sampling depth) during the indicated period. The August - September season of 1961 through 1966 is presented because the frequency of sampling was generally on a daily basis during the low river flow period of these years. The sampling stations are located close enough so that, from a practical point of view, they may be considered synoptic. It will be noted that higher oxygen values occurred in 1964. The decreased frequency of the lower DO values resulted from above average river flows (Fig. 9) and low water temperatures that prevailed during this period. From Table IV, it is quite evident that the water quality in 1966 has been improved over that extant during the preceding five years; moreover, this improvement occurred in spite of the fact that the summer of 1966 was one of the driest on record.

BOD Discharge

In the summer of 1966, Weyerhaeuser had their treatment plant operating and Rayonier greatly improved the efficiency of their recovery plant. Inasmuch as the Rayonier recovery plant burns spent sulfite liquor (SSL), less SSL was pumped to the lagoon on Rennie Island in 1966. The reduced loadings of SSL to the Island allowed for the discharge of bleach plant wastes into the lagoon instead of the receiving waters. Prior to the advent of the recovery system, the bleach plant wastes were discharged into the receiving waters. Figure 16 is a frequency curve of BOD discharge. The average discharge was approximately 87,000 pounds of BOD per day. This is one of the best performances ever realized by Rayonier. During the summer of 1966, the average Rayonier - Weyerhaeuser combined loading into the Harbor was about 143,000 pounds of BOD per day. Of this amount, Weyerhaeuser contributed an average of 56,000 pounds and Rayonier contributed an average of 87,000 pounds of BOD. Even at these relatively low loadings, the oxygen concentrations were below 5 ppm most of the time. It is concluded that a standard of 5 ppm would be impossible to meet under present operating conditions and river flows. Even if there were only 100,000 pounds of BOD discharged each day, the data indicate that 5 ppm would still be extremely difficult to meet during low flow conditions. It should be reemphasized, at this time, that river flows do not necessarily increase the assimilative capacity in terms of oxygen supply. Instead, the river accelerates the dispersal function and thereby decreases the retention time, as heretofore discussed. This is especially true because, as mentioned before, the oxygen contribution by the river is extremely small when compared with the oceanic contribution; moreover, the latter is a relatively constant renewing input. It is therefore concluded that the decreased oxygen values during low flow periods, as contrasted to the winter periods, is primarily due to an increased retention time rather than a lack of oxygen.

The flushing of wastes by the river in 1965 and 1966 was essentially the same owing to the similarity in flow conditions. This is shown in Figure 9. The average river flows in cfs are shown in Table VII. Owing to the similarity of river conditions for these two years, the oxygen deficit for September of each year is compared. The purpose of the comparison is to ascertain if the lower BOD discharge occurring during 1966 resulted in less of an oxygen deficit than that observed in 1965 when the BOD loadings were considerably higher. The August loadings from Weyerhaeuser and Rayonier for the years of 1965 and 1966 remained essentially the same. The total loadings for August of 1965 and 1966 were respectively 160,700 and 157,000 pounds of BOD. Consequently, the oxygen deficits for the month of August are not compared. However, the September loadings for 1965 and 1966 were very different; these loadings were respectively 192,900 and 137,000 pounds of BOD. From Table VIII, it can be seen that the deficit was only slightly less in 1966 than in 1965, in spite of a difference of 55,900 pounds of BOD loading.

Use of the Harbor

The easterly portion of the Harbor is primarily used for industrial purposes. The industrial area may be considered as extending from the western tip of Moon Island to the Chehalis River in the vicinity of Cosmopolis (Fig. 1). This area has the following activities and uses:

1) Dispersal and assimilation of wastes
2) Navigation
3) Log sorting, storage and transportation
4) Ocean vessel docking, loading and unloading
5) Cooling water
6) Dredging to maintain channel depth
7) Upstream and downstream fish migration
8) Gill net fishing
9) Fish passage, rearing and feeding

Compatibility of Uses and Activities

The gill net fishery for both Grays Harbor and Willapa Harbor is an inside fishery in that all fish are taken within the Harbor. The stocks of fish are native to these areas; consequently, individuals making up the population are subject, during upstream and downstream migration, to ecological conditions prevailing during these times. If the environment has a deleterious effect the results should be manifested in the landing records. On the other hand, if landing records compare favorably with other areas where there are no industries having great quantities of organic discharge, it must be concluded that there is no apparent effects from the industrial effluents.

Figure 17 compares the gill net licenses issued at Willapa Harbor and Grays Harbor from 1935 through 1964. The 30-year averages of both areas are almost identical. At Willapa Harbor, an average of 130 licenses were issued each year in contrast with an average of 123 per year at Grays Harbor. Peak years in Willapa Harbor occurred in 1946 and 1958; the minimum years for that area were in 1939 and 1964. The peak years for Grays Harbor were in 1940, 1948 and 1960; the minimum years were in 1942 and 1955. During the latter four years, both areas showed a downward trend in the issuance of licenses. Both areas manifested similar cycles in the number of licenses issued during the 30-year period.

Silver salmon landings are compared for Grays Harbor and Willapa Harbor in Figures 18 and 19. The landing record is from 1935 through 1964. The statistics are in the form of catch per license issued; therefore, in a sense the data represents catch per unit effort. Both areas show similar cyclic variation. The peak catch per unit effort in Willapa and Grays Harbors occurred in 1952. After 1952, the landings in both areas declined in a similar manner. The decline in Willapa Harbor from 1951 through 1964 was at an average of 25 fish per license issued. In Grays Harbor, for the same period, the decline was 28 fish per license issued. From these data it is concluded that the decline in silver salmon caught in both areas was essentially the same. Therefore, the discharge of industrial wastes into Grays Harbor did not make any difference in fish production as compared to Willapa Harbor where essentially no wastes are discharged. Trends were determined by regression analysis of the data in this and following cases.

Chum salmon are compared in the same manner, as was done with the silver salmon, in Figures 20 and 21. Here again, the curves are very similar and the decline in Grays Harbor from 1951 through 1964 was 50 fish per license while in Willapa Harbor it was 56 fish per license. It is again concluded that, on the basis of fish statistics, wastes discharged into Grays Harbor are not affecting the survival of fish in such a manner as to decrease the catch.

Chinook salmon are compared in the same manner as for chum and silver salmon in Figures 22 and 23. The curves for Grays Harbor and Willapa Harbor are very similar. From 1951 through 1964 both areas had a slight increase in production. This increase was so slight as to have no signifinance in terms of the amount of fish caught. However, both areas show similar cyclic trends of the same magnitude. It is therefore concluded that the discharge of wastes in Grays Harbor does not have a deleterious effect on chinook salmon survival and landings.

Steelhead Trout

Using the statistics supplied in a report by M. Katz entitled "Trends in the Steelhead Sports Fishing in the State of Washington with Emphasis on the Fishery in Streams of the Puget Sound, Hood Canal and Grays Harbor Areas",[13] a comparison of the steelhead fishery for the Humptulips and Chehalis River system was carried out. For the purpose of this comparison, data for the Chehalis River system includes the statistics from the Wynoochee, Satsop and Chehalis River. The rational for treating these two tributary streams as part of the Chehalis system stems from the fact that fish caught in the Chehalis River could have been planted in one of the two tributaries. The data in Table IX represents a compilation of the steelhead plants (at migratory stage of development) for the period of 1945 through 1962. In a similar manner, the returning adult steelhead taken by sportsmen during the period of 1947 through 1964 have been totaled. It will be noted that the catch data has been offset two years from the plant data. This is in accordance with the accepted two year cycle associated with the steelhead fishery (Katz op. cit.). From Table IX, it is concluded that the steelhead sports fishery in the Chehalis River system compares favorably with that of the Humptulips. Inasmuch as the catch per plant ratio of the two areas are similar, it is also concluded that downstream and upstream migrants are not apparently suffering any ill effects from their passage through the waste dispersal and assimilation zone.

Oyster Production

Oyster production is extensively carried out at Grays Harbor in North and South Bay (Fig. 1). In this Harbor, even if the water temperature becomes sufficiently warm enough for spawning, there will still be little or no spat set. The spat fail to set because the larvae must be in the water in excess of thirty days before they set. This is impossible because of the rapid flushing time in the oyster growing areas of Grays Harbor. The oyster larvae will be swept out to sea where they will be further dispersed. Only a few, if any, will return to the Harbor to set. Furthermore, the colder oceanic temperature is inimical to their survival. Consequently, it is concluded that Grays Harbor cannot be used as an area for oyster spawning and setting. However, it can be used for a growing area whereby spat are purchased elsewhere and placed in appropriate growing grounds within the Harbor. An examination of oyster production records from Grays Harbor reveals that, compared to other places, this is one of the few areas which show increasing production.

When oyster production at Grays Harbor is compared with production at Willapa Harbor, where no extensive industry exists, it is seen that Grays Harbor production (based on records from 1935 to 1964) shows an average increase of 3,496 gallons per year. (Fig.24). In contrast, over the same period of time, production in Willapa Harbor decreased at the rate of 11,174 gallons per year (Fig. 25). Consequently, it is concluded on the basis of these records that, within the limits of growing space, conditions for oyster propagation in Grays Harbor are the same or better than those existing in Willapa Harbor. It is also concluded that the dispersal and assimilation of waste in the more easterly portion of the Harbor, near Aberdeen and Hoquiam, does not create adverse conditions for oyster growing in North and South Bay; therefore, waste assimilation at the head of the estuary and oyster growing in the western portion of the Harbor is compatible.

Photosynthesis

The effect of industrial and domestic waste on the food chain, especially the phytoplankton, is of interest. Waste effluents may cause excessive eutrophication resulting in extensive plankton blooms which could eventually cause a lowering of the DO concentration when the plants die. On the other hand, some wastes may be toxic and prevent photosynthesis. When this occurs, inorganic materials are not converted to fats, carbohydrates and proteins. The lack of organic foods for herbivores, and eventually carnivores, tend to decrease the quantity and quality of fish making up the biota of the receiving waters.

As a result of the foregoing considerations, a laboratory study was carried out to ascertain the effect of SSL on the photosynthesic activity of Monochrisis lutheri, a known oyster food (Stein et al.) [14]. In this study, the photosynthetic activity was measured as a function of the amount of carbon-14 removed from the environment. The photosynthesis rate was studied at varying concentrations of SSL (Fig. 26 through 32). From this study, it is concluded that SSL actually stimulates photosynthesis within the range of concentrations tested (i.e. zero to 200 ppm of SSL). In view of the fact that the average SSL concentration at Grays Harbor is less than the upper concentration involved in this experiment, it is concluded that mill wastes are not adversely affecting plankton phytosynthesis.

In Grays Harbor, the phenomenon that probably has the greatest effect on photosynthesis is the natural turbidity of the water rather than the presence of wastes. In any case, there appears to be an adequate food chain as indicated by good steelhead and salmon runs and by the frequent presence of large schools of anchovies and other plankton feeders. Also, the presence of a successful oyster industry further attests to an ample food chain, expecially with respect to phytoplankton. The latter observation is based on the fact that oysters feed primarily, if not solely, on phytoplankton.

DISCUSSION AND CONCLUSIONS

The Grays Harbor estuary is subject to many uses. Most of the uses and activities are carried out in the more easterly portion of the Harbor near the cities of Hoquiam and Aberdeen. All of these uses are vital to the economy of the area. In fact, the wood product industry is the reason for the existence of the Grays Harbor community as an economic unit. The uses of the estuary by the various industries has created a waste dispersal and assimilation zone through which fish must pass during their upstream and downstream migrations. This zone has a lower oxygen concentration relative to the rest of the Harbor. Fish landings have shown that, in spiet of the existence of the waste dispersal zone, the Grays Harbor fishery compares favorably with similar areas, such as Willapa Harbor, which has essentially no industries which discharge substantial amounts of organic wastes.

In the 1930s, as indicated by Eriksen and Townsend (op.cit.), there were a number of fish kills brought about by substantial discharges of organic wastes which depleted the oxygen content. Subsequent to these kills, Rayonier Incorporated commenced a water quality program which has resulted in a steady improvement in water quality. This improvement has taken place in spite of increased production and the appearance of additional waste discharges into the Harbor. The program is continuing today; moreover, as new technics and procedures for environmental protection are developed, they will, where economically feasible, be put into practice.

Some of the conclusions drawn from this report are as follows:

(1) The deposition of silt carried by the rivers requires a continuous dredging program to allow for the navigation of oceangoing vessels.

(2) Extensive tide flats, sand bars and shoal waters within the Harbor make boating and water skiing a hazardous recreation.

(3) Lack of beaches within the estuary precludes bathing and swimming as a popular recreation within the area.

(4) In the oystering area, warm water temperatures do not last long enough to "trigger" oyster spawning.

(5) If the temperature did allow for spawning, most of the larvae would be swept out to sea before they set. Therefore, the area should not be set aside for oyster spawning.

(6) In the estuary, the main effect of river flow on waste assimilation is to decrease retention time.

(7) Most of the oxygen within the area is contributed by the ocean and not by the river system.

(8) Low salinities in the easterly portion of the Harbor, near the inlet, precludes this as an oyster growing area. However, the salinities are still high enough to make the waters unusable as process water.

(9) The waste dispersal and assimilation zone extends from the western tip of Moon Island to Cosmopolis. This is the area over which waters having the lowest oxygen values move back and forth with the tides. At lower low water, the volume of the dispersal zone is 1.52 billion cubic feet or only 11.1 percent of the total harbor volume at mean lower low tide.

(10) Within the dispersal zone, an area of lower oxygen concentration is found between Stations 52 and 58. This small portion of water has a volume of 0.34 billion cubic feet and represents only 2.7 percent of the Harbor's entire lower low tide volume. The remaining 97.3 percent of the Harbor remains, from a practical point of view, unaffected and available for aquatic organisms.

(11) Over the years, there has been a gradular improvement in water quality; however, the stage has been reached where further improvements will result only in minor increases in oxygen concentration.

(12) In the summer of 1966, there was a reduction of BOD loading of 55,900 pounds below that of 1965. In spite of the substantial drop in BOD discharge, the oxygen deficit in the receiving waters was only slightly less than in 1965. In 1965 the average oxygen deficit for Stations 52, 53 and 58 was 4.68; in 1966 the average was 4.26 or only 0.42 ppm less.

(13) The slight improvement in oxygen concentration resulting from the 55,900 pound reduction in BOD loading gives a low benefit to cost ratio. Furthermore, the 0.42 ppm of oxygen change would not improve the biota to a significant or measurable degree.

(14) Historical records have shown that finfish and shellfish production from Grays Harbor compare favorably with those of Willapa Harbor where there are no industries discharging large amounts of organic wastes. The landing records include periods during which the average DO was lower than 4 ppm with minimum values frequently lower than 3 ppm. In spite of this, the fishery compared favorably with

Willapa Harbor. It was also found that present listed fishery uses are compatible. Consequently, it is recommended that an average of 4 ppm, at any station, with a minimum of 3 ppm be the standard for the dispersal and assimilation zone. The minimum should last no longer than 25 percent of a day. This standard is above values of preceding years and will definitely protect the passage of fish without causing mortalities or any other physiological injury that would measurably decrease fish production.

(15) In any water management program, the effect of upwelling and long tidal run-outs on DO should be taken into consideration.

J.E. Stein
J. E. Stein

J.G. Denison
J. G. Denison

mah/mbb
February 8, 1967

Project No. 19:71

REFERENCES: (1) "Standard Methods for the Examination of Water and Wastewaters", Eleventh Edition, 1960, American Public Health Association, New York.

(2) H. U. Sverdrup, M. W. Johnson, and Richard H. Fleming, "The Oceans", Prentice-Hall Inc. 1942.

(3) State of Washington Department of Fisheries 1964 Annual Report.

(4) George R. Reid, "Ecology of Inland Waters and Estuaries", Reinhold Publishing Company, New York, 1961, pg. 74.

REFERENCES:

(5) B. H. Ketchum, "The Flushing of Tidal Estuaries and Industrial Wastes", February 1951, Volume 23, Number 2, Pages 192-208.

(6) O. Goldschmid, and F. L. Maranville, "Improved Spent Sulfite Liquor Determination by the Nitrosolignin Method", Analytical Chem., March 1959, Volume 31, Number 3 Pages 370-374.

(7) Ralph J. Callaway, "Simulation of Upwelling and Pollution in a Vertically Mixed Estuary, Second International Oceanographic Congress, Moscow, USSR, June 3, 1966.

(8) Anne Eriksen and L. D. Townsend, "The Occurrence and Cause of Pollution in Grays Harbor, Washington", State Pollution Series, Bulletin Number 2, Circa 1939, Page 28.

(9) Peter Doudoroff and Dean Shumway, "Dissolved Oxygen Criteria for the Protection of Fish", American Fisheries Society, Special Publication Number 4, 1967, Pages 13-19.

(10) J. E. Stein and J. G. Denison, Report E 360:0-9, (April 15, 1966).

(11) M. M. Ellis, U. S. Bureau Fish. Bull. 48 (22): 365-437, (1937), Page 371.

(12) Erman A. Pearson and George A. Holt, "Water Quality and Upwelling at Grays Harbor Entrance", Limnology and Oceanography 5, Pages 48-56.

(13) Max Katz and Wayne Heinz, "Trends in the Steelhead Sports Fishery in the State of Washington with Emphasis on the Fishery in Streams of the Puget Sound, Hood Canal and Grays Harbor Areas", Unpublished.

(14) J. E. Stein and G. R. Quimby, Report E 360:1-12, (March 6, 1961).

TABLE I

A TABULATION OF DATA RESULTING FROM CONTINUOUS SAMPLER OBSERVATIONS FROM 10:00 P.M. ON NOVEMBER 19 THROUGH 7:00 A.M. ON NOVEMBER 24, 1964.

Time in Hours	PBPM in ppm	Log of PBPM	Time in Hours	PBPM in ppm	Log of PBPM
0.0	90	4.500	49.8	56	4.025
2.0	121	4.796	51.0	50	3.912
4.0	90	4.500	54.0	42	3.738
6.0	98	4.585	56.0	44	3.784
8.0	117	4.762	59.0	52	3.951
10.5	108	4.682	60.0	50	3.912
12.0	81	4.394	62.0	63	4.143
15.0	43	3.761	64.0	53	3.970
16.5	39	3.664	66.0	37	3.611
18.5	72	4.277	68.0	36	3.584
20.0	80	4.382	70.0	43	3.761
22.2	55	4.007	72.0	36	3.584
24.0	64	4.159	74.0	42	3.738
26.0	75	4.317	76.0	46	3.829
28.0	68	4.220	78.0	37	3.611
30.0	55	4.007	80.0	36	3.584
32.0	65	4.174	82.5	42	3.738
35.8	65	4.174	84.0	43	3.761
38.0	51	3.932	85.8	42	3.738
40.0	38	3.638	88.4	39	3.664
42.0	36	3.584	92.0	36	3.584
44.0	56	4.025	98.5	40	3.689
46.8	43	3.761	101.0	41	3.714
48.4	47	3.850	105.0	44	3.784

TABLE II

SUMMARY OF MATHEMATICAL EXPRESSIONS DESCRIBING THE QUANTITIES OF WASTE REMOVED AND REMAINING OVER A FIVE-DAY PERIOD

Time in Days	Removed	Remaining
0	-------	$C_o (A)^0$
1	$C_o P (A)^0$	$C_o (A)^1$
2	$C_o P (A)^1$	$C_o (A)^2$
3	$C_o P (A)^2$	$C_o (A)^3$
4	$C_o P (A)^3$	$C_o (A)^4$
5	$C_o P (A)^4$	$C_o (A)^5$

C_o = Quantity of waste at start
P = Proportion of waste removed at each time unit
A = 1-P

TABLE III

COMPARISON OF PBPM CONCENTRATIONS OBSERVED AND PREDICTED FROM MID-DEPTH SAMPLES IN THE NORTH CHANNEL AT GRAYS HARBOR

Station	Observed Mid-depth Conc. on Nov. 20	Observed Mid-depth Conc. on Nov. 24	Predicted Mid-depth Conc. for Nov. 24	Percent Error
58	99	34	34	0.0
53	101	33	35	6.1
52	84	31	29	6.4
50	71	23	25	8.7
Average	88.75	30.35	30.8	1.8

Computed from $C_t = Co (A)^t$ where: C_t = Remaining concentration on November 24; C_o = Concentration observed on November 20; A = (1-P)=(1-0.191)= 0.809; t = Five days.

TABLE II

SUMMARY OF MATHEMATICAL EXPRESSIONS DESCRIBING THE QUANTITIES OF WASTE REMOVED AND REMAINING OVER A FIVE-DAY PERIOD

Time in Days	Removed	Remaining
0	-------	$C_o\ (A)^0$
1	$C_oP\ (A)^0$	$C_o\ (A)^1$
2	$C_oP\ (A)^1$	$C_o\ (A)^2$
3	$C_oP\ (A)^2$	$C_o\ (A)^3$
4	$C_oP\ (A)^3$	$C_o\ (A)^4$
5	$C_oP\ (A)^4$	$C_o\ (A)^5$

C_o = Quantity of waste at start
P = Proportion of waste removed at each time unit
A = 1-P

TABLE III

COMPARISON OF PBPM CONCENTRATIONS OBSERVED AND PREDICTED FROM MID-DEPTH SAMPLES IN THE NORTH CHANNEL AT GRAYS HARBOR

Station	Observed Mid-depth Conc. on Nov. 20	Observed Mid-depth Conc. on Nov. 24	Predicted Mid-depth Conc. for Nov. 24	Percent Error
58	99	34	34	0.0
53	101	33	35	6.1
52	84	31	29	6.4
50	71	23	25	8.7
Average	88.75	30.35	30.8	1.8

Computed from $C_t = Co\ (A)^t$ where: C_t = Remaining concentration on November 24; C_o = Concentration observed on November 20; A = (1-P)=(1-0.191)= 0.809; t = Five days.

February 2, 1967

G 10:1-5

TABLE IV

COST IN MONITORING

Year	Cost
1961	9,350
1962	10,030
1963	12,520
1964	13,700
1965	25,300
1966	32,940
Total	103,840

TABLE V

ABATEMENT EQUIPMENT INSTALLED, ITS COST AND PURPOSE

Year	Type of Installation	Purpose	Cost
1942	Rennie Island lagoon	Store waste during low river flow	107,000
1946	Pipeline to Rennie Island	Line leaked - not strong enough	46,900
1951	Cooling equipment and storage tanks	Prevent SO_2 from entering receiving waters	84,200
1951-1952	Rennie Island	Increase size	234,800
1953-1954	Blow pit modifications and weak liquor washing system	Improve storage capacity on Rennie Island	61,000
1954	Replace Rennie Island line	Prevent wastes from leaking into receiving water	66,700
1956	Collecting and screening devices	Prevent knots and fibers from entering receiving water	191,000
1957	Improve liquor draining on Rennie Island	Provide better dispersion when lagoon is emptied	40,600
1958	Combined sewers	Provide for better inplant monitoring	22,000
1960	Improve controls on draining equipment	Provide for better control on drainage	7,700

TABLE V - Continued

Year	Type of Installation	Purpose	Cost
1962	Start new recovery system	Prevent liquor waste from going to receiving water. Allow room on Rennie Island for other wastes	7,450,000
1962-1965	Development cost of new recovery system	________	951,000
1963	Alarm system on piping to Rennie Island	Detect leaks from pipeline	21,000
1964	Sewer sampler	Improve monitoring	4,000
1965	Rewashers	Improve capacity to Rennie Island by pumping more waste in less volume	1,204,000
1965	Equipment to capture organics from bleach plant	Pump waste to Rennie Island	122,000
1966	Modify recovery system	Improve burning capacity of recovery system	600,000
		Total Cost	11,213,900

TABLE VI

CUMULATIVE PERCENT OCCURRENCE OF DISSOLVED OXYGEN AT OR BELOW THE INDICATED VALUE FOR ALL SAMPLES OBTAINED IN AUGUST AND SEPTEMBER AT THREE SURVEY STATIONS IN GRAYS HARBOR

Station 52 (Rayonier mill site)

Year	Dissolved Oxygen Concentrations						Number of Samples
	2.5	3.0	3.5	4.0	4.5	5.0	
1961	11.9	42.8	57.1	83.3	88.1	92.8	42
1962	13.0	20.3	29.0	44.9	65.2	86.9	69
1963	6.4	26.9	63.4	81.7	92.4	95.7	93
1964	0.0	1.8	7.3	27.3	54.5	70.9	55
1965	0.0	7.0	49.6	72.7	81.8	88.8	143
1966	0.0	1.7	11.0	44.5	67.6	86.7	173

Station 53 (DO sag point)

	Dissolved Oxygen Concentrations						
	2.5	3.0	3.5	4.0	4.5	5.0	
1961	24.4	46.7	60.0	68.9	84.4	93.3	45
1962	8.9	25.3	30.4	46.8	67.1	83.5	79
1963	16.7	44.4	63.3	73.3	80.0	87.8	90
1964	0.0	1.8	15.8	33.3	56.1	71.9	57
1965	0.0	19.8	46.1	66.7	74.5	81.6	141
1966	0.0	2.4	18.7	50.6	64.4	77.7	166

Station 34 (Hoquiam River)

	Dissolved Oxygen Concentrations						
	2.5	3.0	3.5	4.0	4.5	5.0	
1961	55.6	61.1	83.3	100.00	100.00	100.00	18
1962	12.5	25.0	62.5	79.2	100.00	100.00	24
1963	21.4	50.0	76.2	90.5	92.8	97.6	42
1964	0.0	25.0	50.0	65.0	75.0	90.0	20
1965	6.4	17.9	56.4	78.2	88.4	97.4	78
1966	0.0	8.3	32.3	76.1	89.6	97.9	96

TABLE VII

AVERAGE FLOWS OF WATER FLOWING IN THE CHEHALIS RIVER DURING THE MONTHS OF AUGUST AND SEPTEMBER IN 1965 AND 1966

Date		River Flow in cfs	Average Flows for the Two Months of Each Year in cfs
Month	Year		
August	1965	769.35	$\bar{x}$ = 694.59
September	1965	619.83	
August	1966	561.45	$\bar{x}$ = 623.56
September	1966	685.67	

TABLE VIII

AVERAGE DISSOLVED OXYGEN DEFICIT FOR THE MONTH OF SEPTEMBER IN 1965 AND 1966

Station	September 1965	September 1966
52	4.81	4.28
53	4.75	4.32
58	4.48	4.19
Average	4.68	4.26

Oxygen deficit is defined as the difference between the observed concentration and that which would occur at 100 percent saturation.

TABLE IX

SUMMARY OF THE STEELHEAD TROUT STATISTICS FOR THE TWO MAJOR DRAINAGE SYSTEMS INTO GRAYS HARBOR

(I) Total Steelhead Planted in Grays Harbor Drainage During the Period of 1945 - 1962.

(A)	Humptulips River	771,700
(B)	Chehalis System	771,000

(II) Total Steelhead Catch from the Grays Harbor Drainage During the Period of 1947 - 1964

(A)	Humptulips River	98,030
(B)	Chehalis System	148,020

(III) Comparative Catch to Plant Ratios for the Two Major River Systems of Grays Harbor

(A)	Humptulips River	0.127
(B)	Chehalis System	0.185

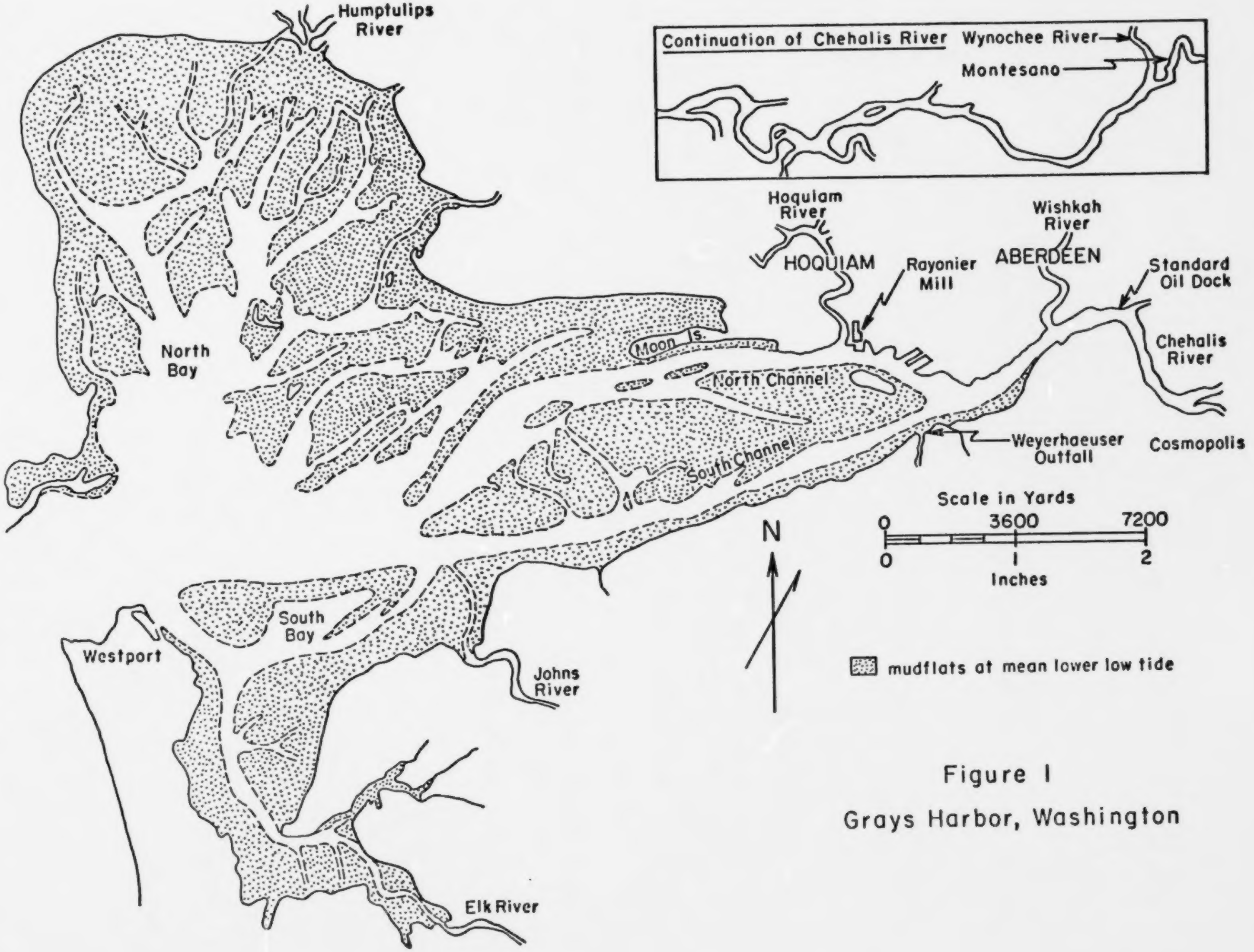

Humptulips River
Continuation of Chehalis River
Wynochee River
Montesano
North Bay
Hoquiam River
HOQUIAM
Rayonier Mill
Wishkah River
ABERDEEN
Standard Oil Dock
Chehalis River
Moon Is.
North Channel
South Channel
Weyerhaeuser Outfall
Cosmopolis
Scale in Yards
0
3600
7200
0
1
2
Inches
N
South Bay
Westport
Johns River
mudflats at mean lower low tide
Elk River

Figure 1

Grays Harbor, Washington

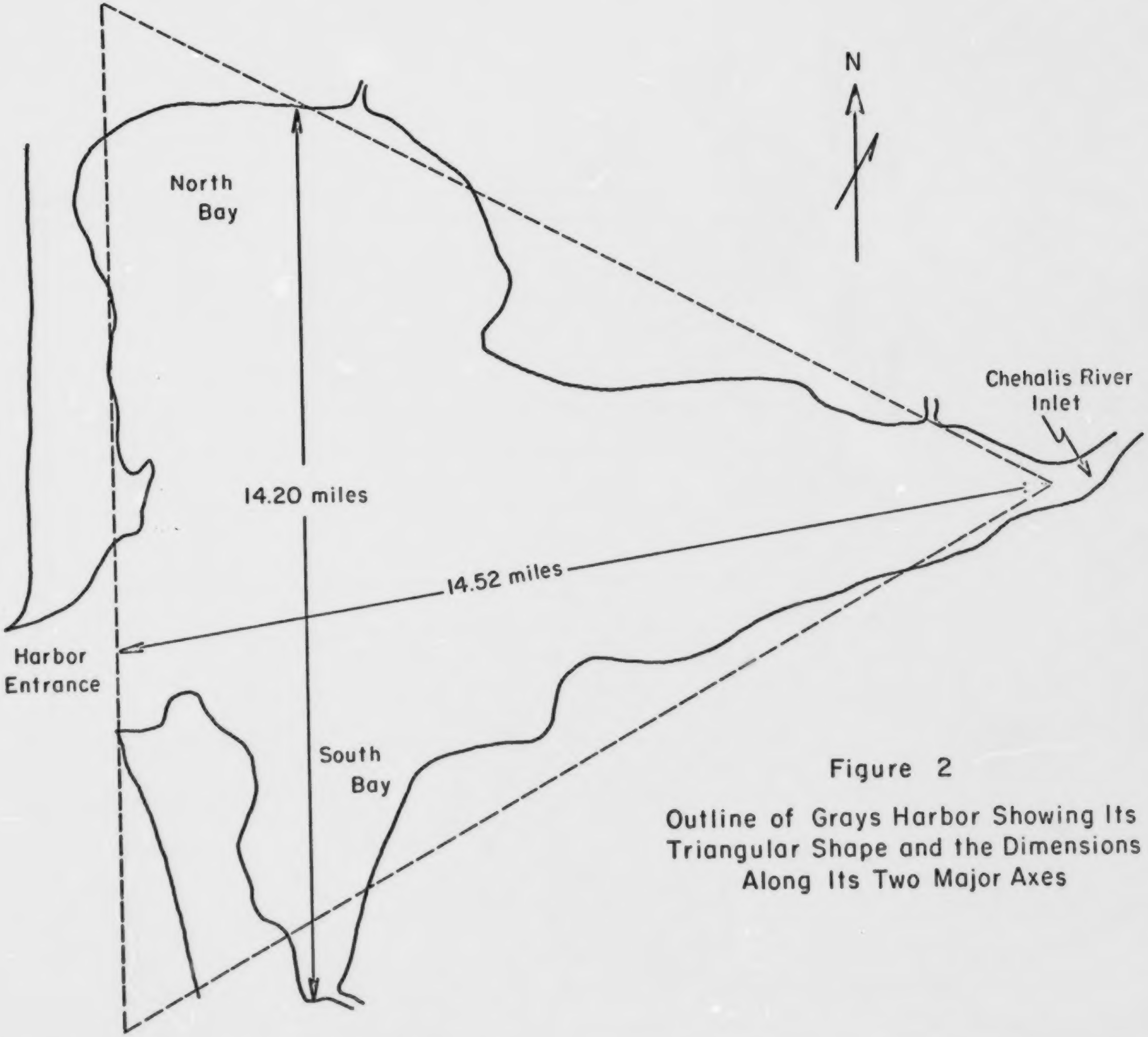
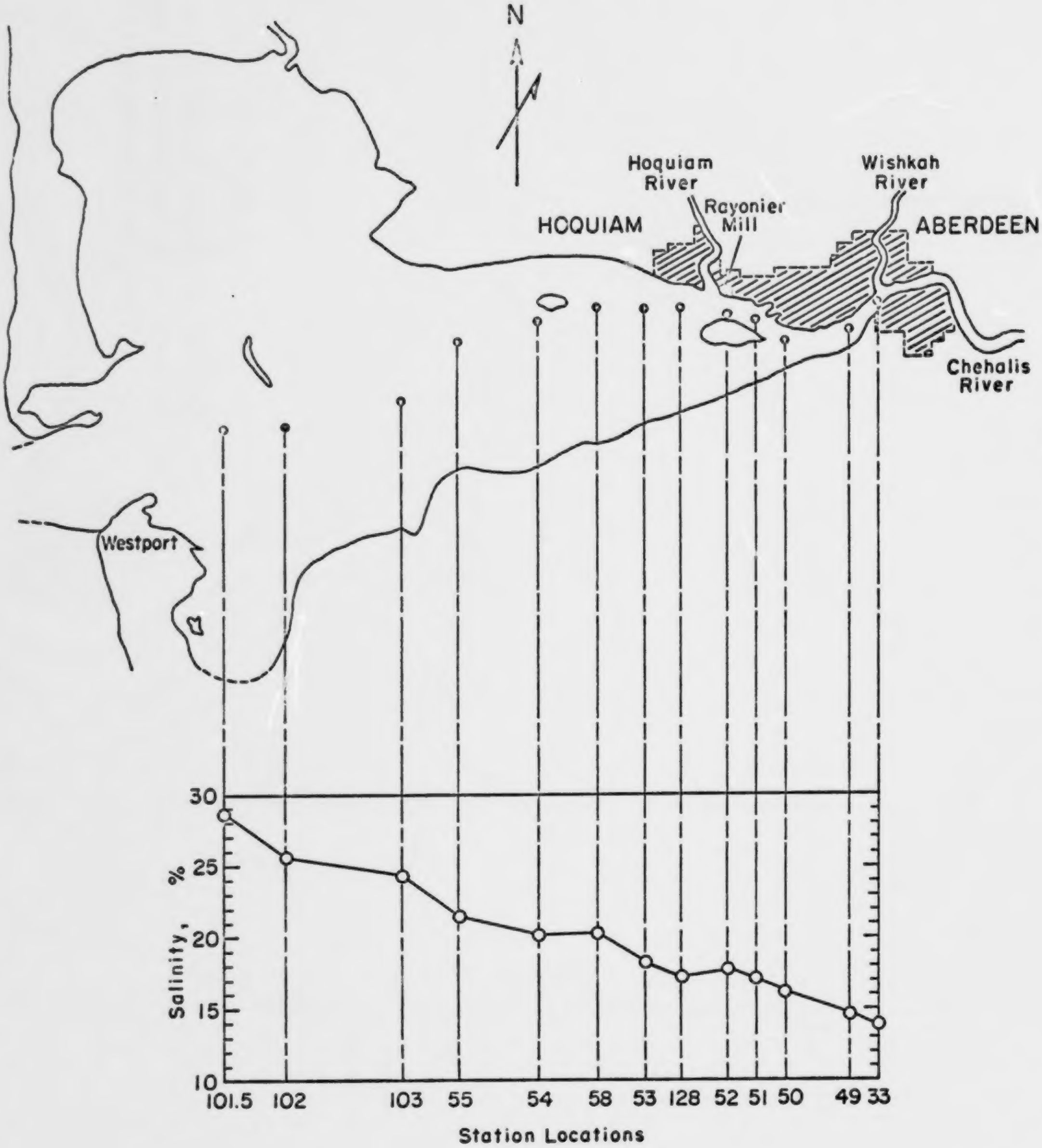

N
North Bay
14.20 miles
14.52 miles
Harbor Entrance
South Bay
Chehalis River Inlet

Figure 2

Outline of Grays Harbor Showing Its Triangular Shape and the Dimensions Along Its Two Major Axes

Figure 3

Suface Salinity Profile at Grays Harbor on October 15, 1966 Showing the Increase in Salinity from East to West



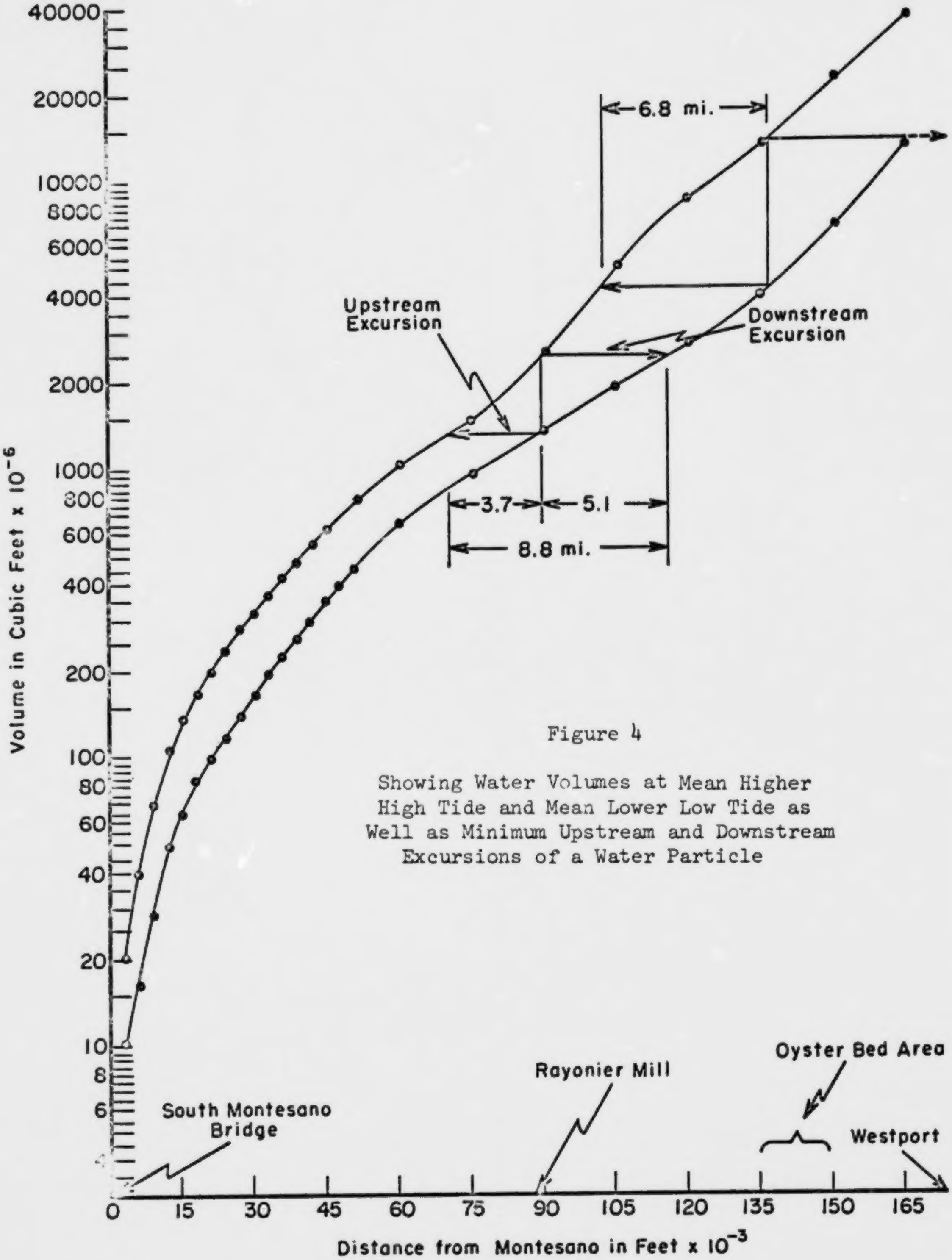


Figure 4

Showing Water Volumes at Mean Higher High Tide and Mean Lower Low Tide as Well as Minimum Upstream and Downstream Excursions of a Water Particle

Figure 5

A Schema Showing the Position of the Continuous Sampler Intake in Relation to the Depths at Which Routine Water Samples are Obtained from the North Channel

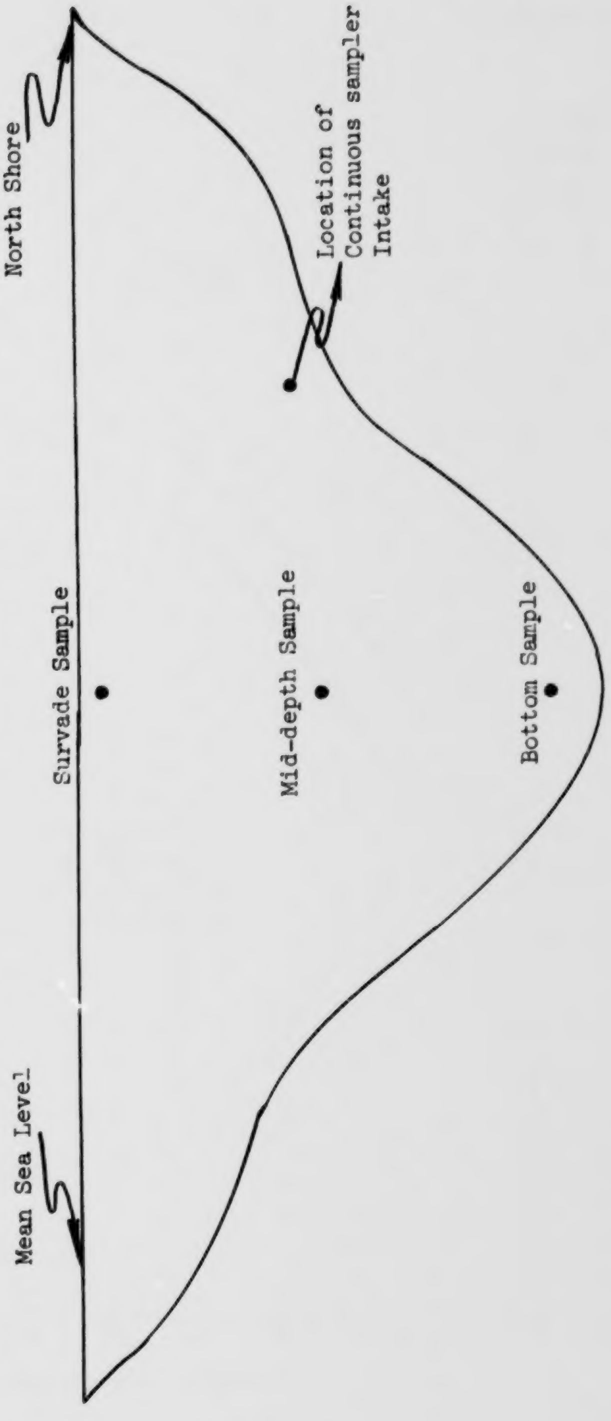

North Shore
Location of Continuous sampler Intake
Survade Sample
Mid-depth Sample
Bottom Sample
Mean Sea Level

Figure 6

A Map Showing the Location of the Continuous Water Sampler in the North Channel Adjacent to the Rayonier Mill. Several Water Sampling Stations Are Also Shown.

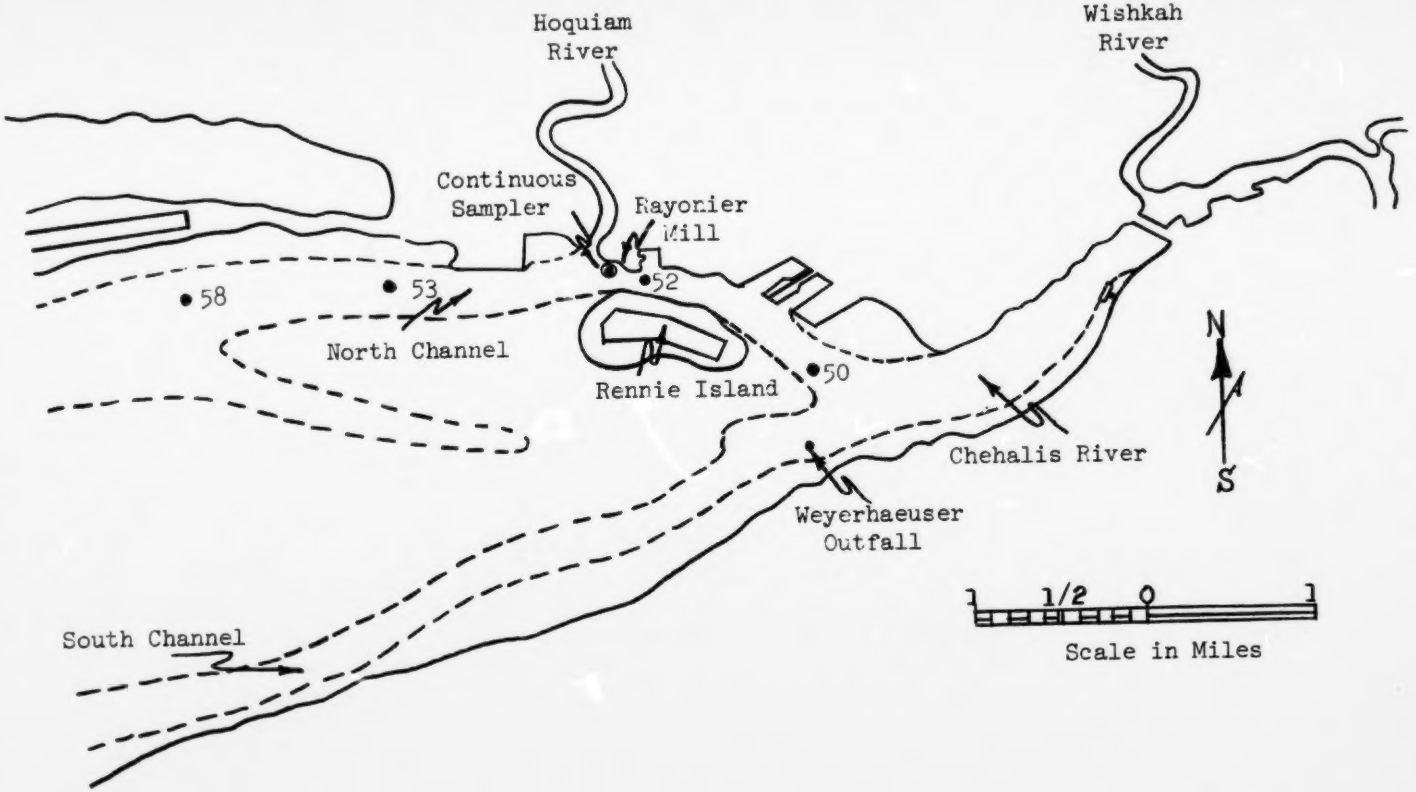
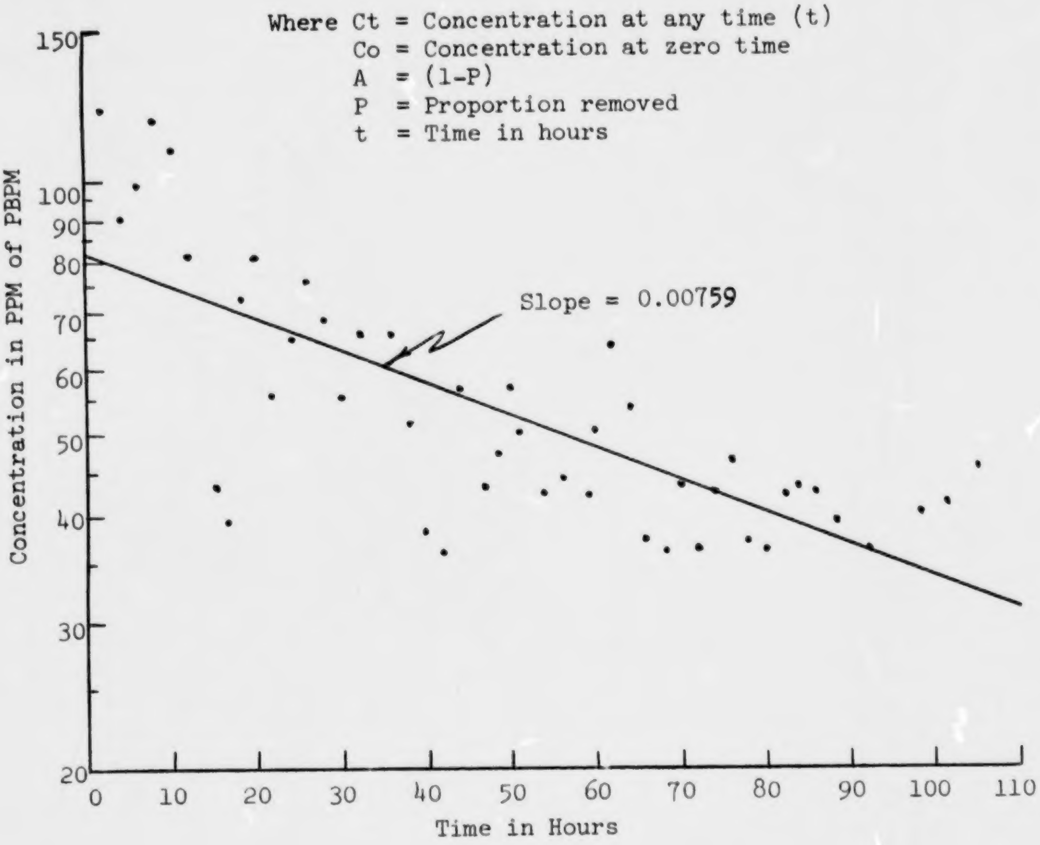

Hoquiam River
Wishkah River
Continuous Sampler
Rayonier Mill
52
53
58
50
North Channel
Rennie Island
Chehalis River
Weyerhaeuser Outfall
South Channel
N
S
1
1/2
0
1
Scale in Miles

Figure 7

A Graph Showing the Regression Line of the Equation LnCt = LnCo + LnA (t) for the Data Presented in Table I



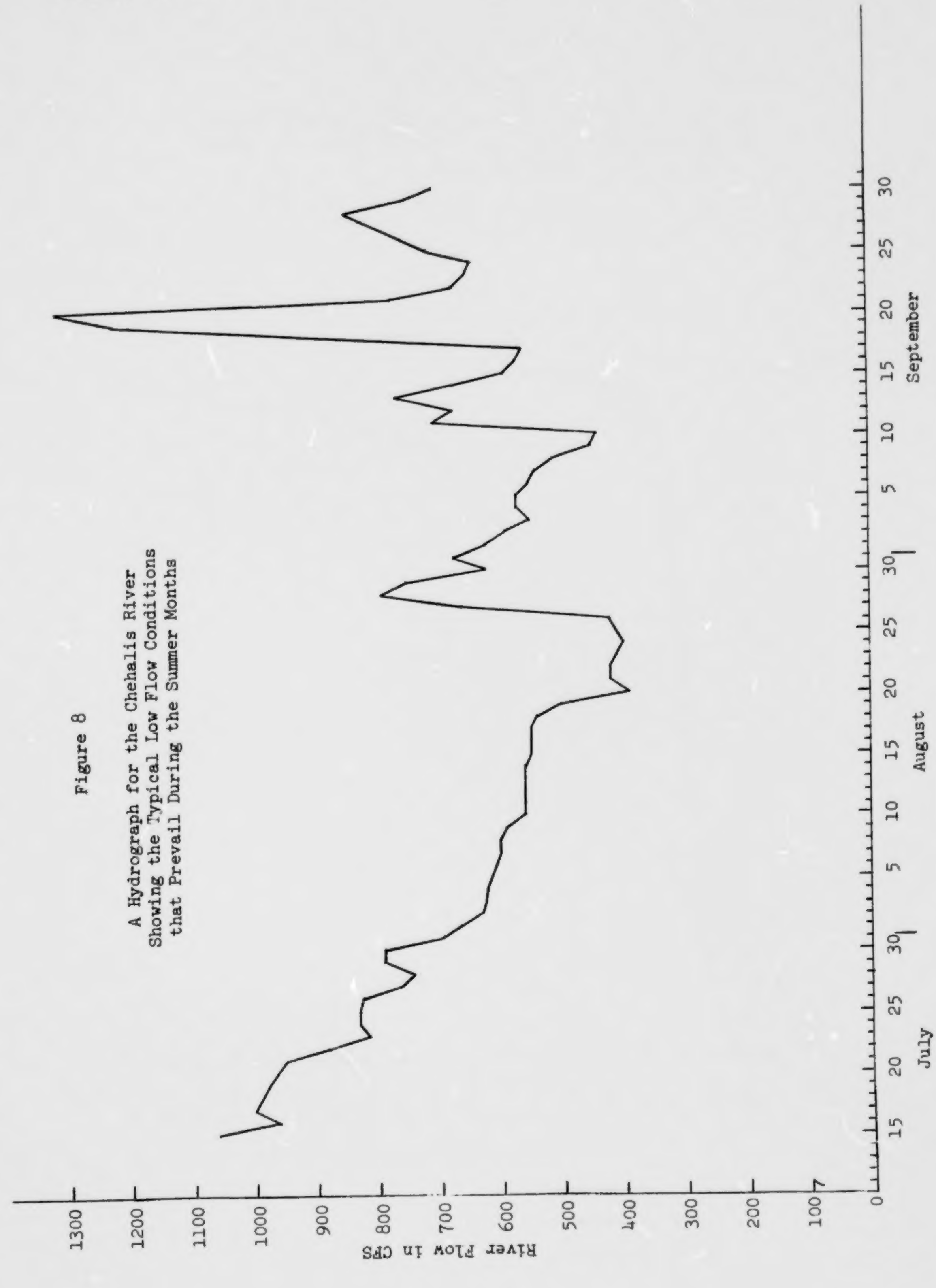


Figure 8

A Hydrograph for the Chehalis River Showing the Typical Low Flow Conditions that Prevail During the Summer Months

Figure 9

Cumulative Percent Frequency Distribution Curve on River Flow (cfs) from Aug. to Sept. 30, 1964, 1965 and 1966

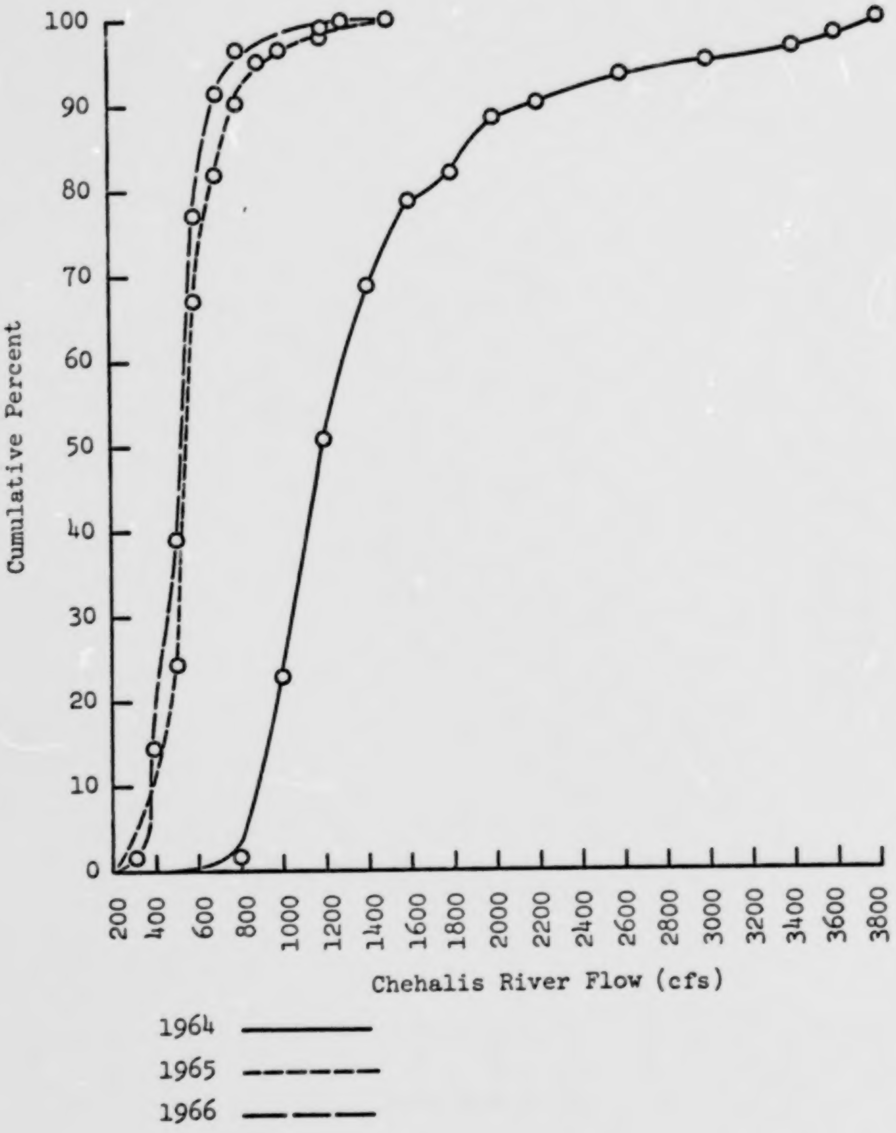


Figure 10

Chlorinity in PPT Versus Oxygen Deficit in PPM
Observed in the Bottom Water at Station 52
Located in the North Channel of Grays Harbor

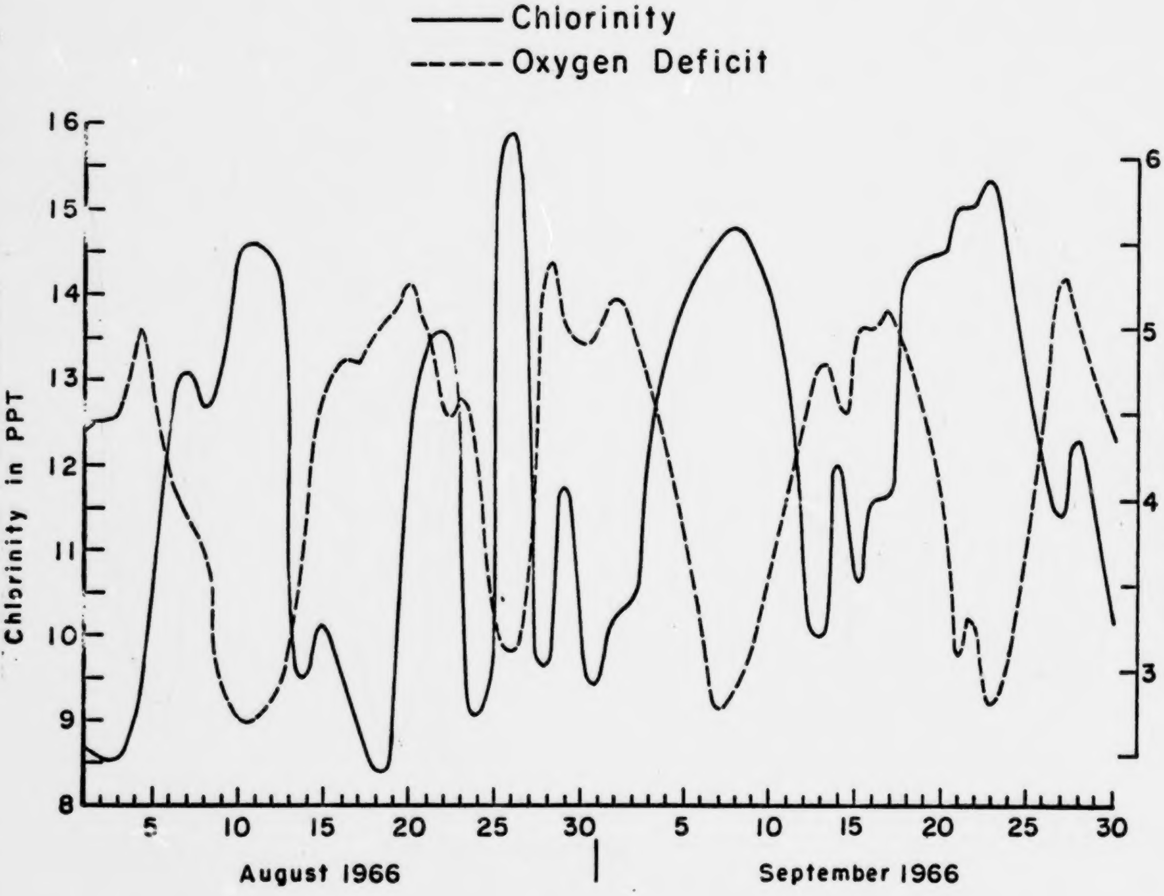
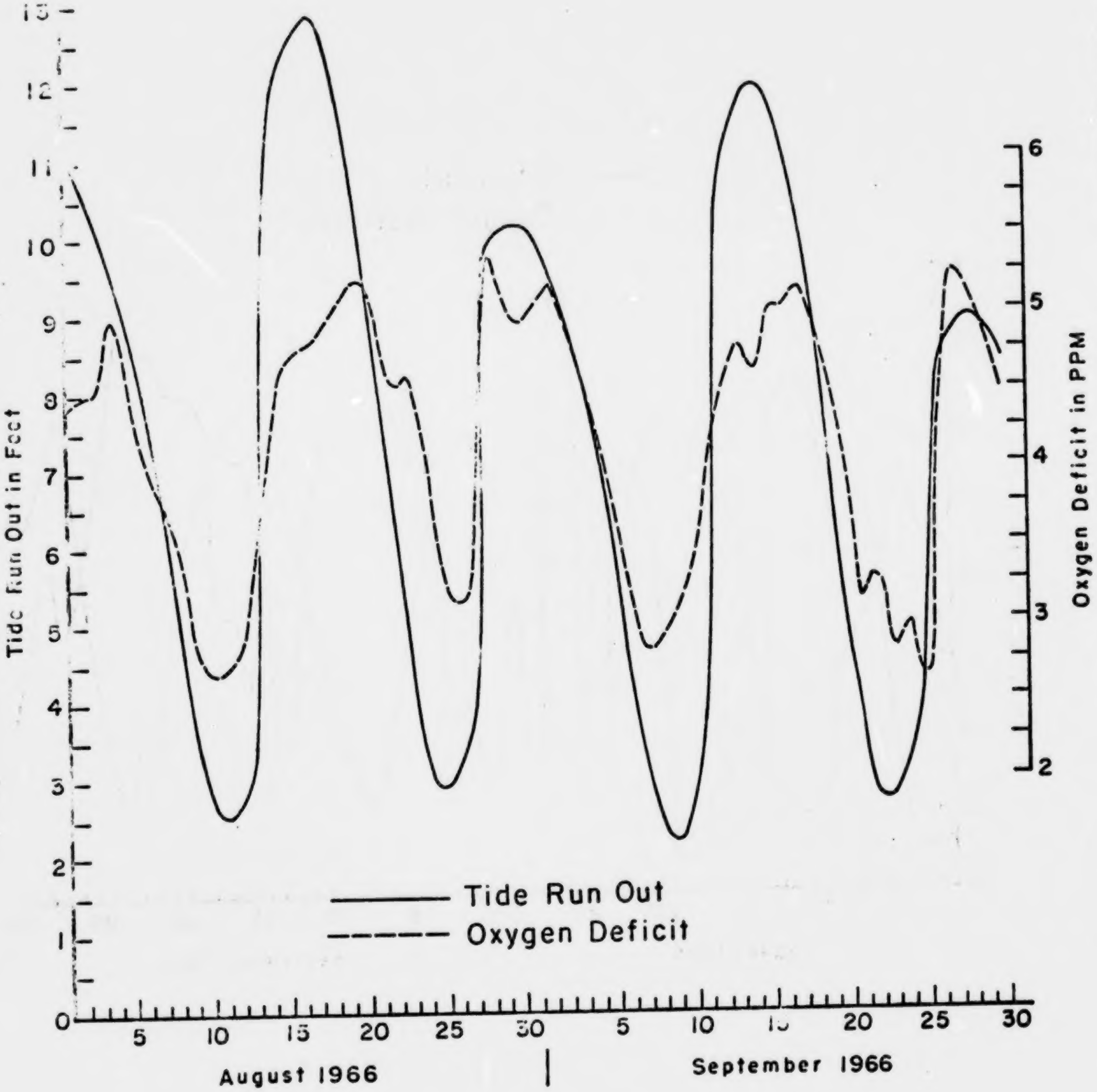


Figure 11

Tide Run Out in Feet During the Six Hours Immediately Prior to the Time of Sampling Versus Oxygen Deficit Observed in the Bottom Water at Station 52 Located in the North Channel of Grays Harbor.



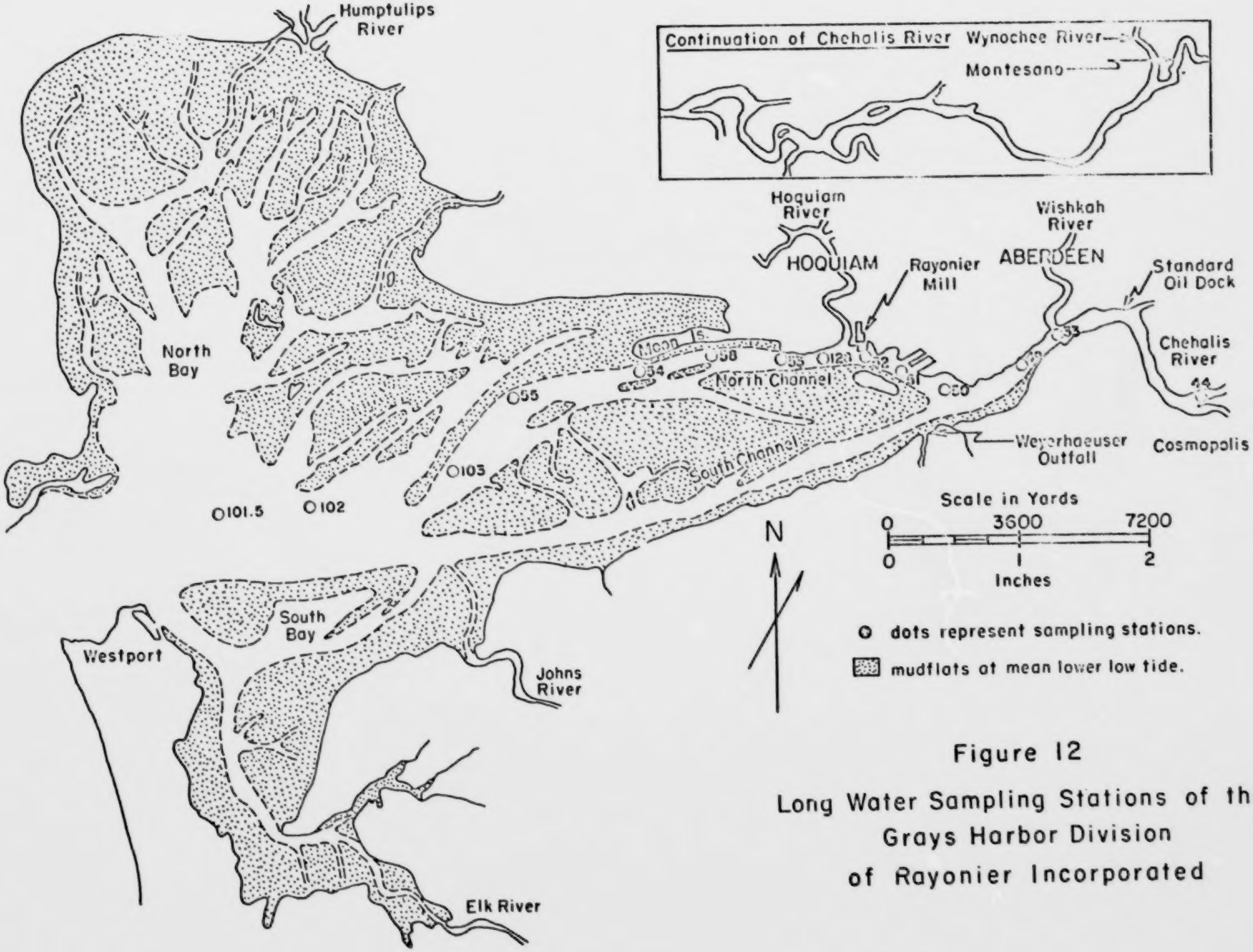

Continuation of Chehalis River
Wynochee River
Montesano
Humptulips River
North Bay
O101.5
O102
O103
O55
O54
Moon Is.
O58
North Channel
O123
O52
O51
O50
O53
South Channel
Hoquiam River
HOQUIAM
Rayonier Mill
Wishkah River
ABERDEEN
Standard Oil Dock
Chehalis River
44
Cosmopolis
Weyerhaeuser Outfall
Scale in Yards
0
3600
7200
0
1
2
Inches
N
O dots represent sampling stations.
▨ mudflats at mean lower low tide.
South Bay
Westport
Johns River
Elk River

Figure 12

Long Water Sampling Stations of the Grays Harbor Division of Rayonier Incorporated

Figure 13

Routine Short Water Trip Sampling Stations
of the Grays Harbor Division of
Rayonier Incorporated

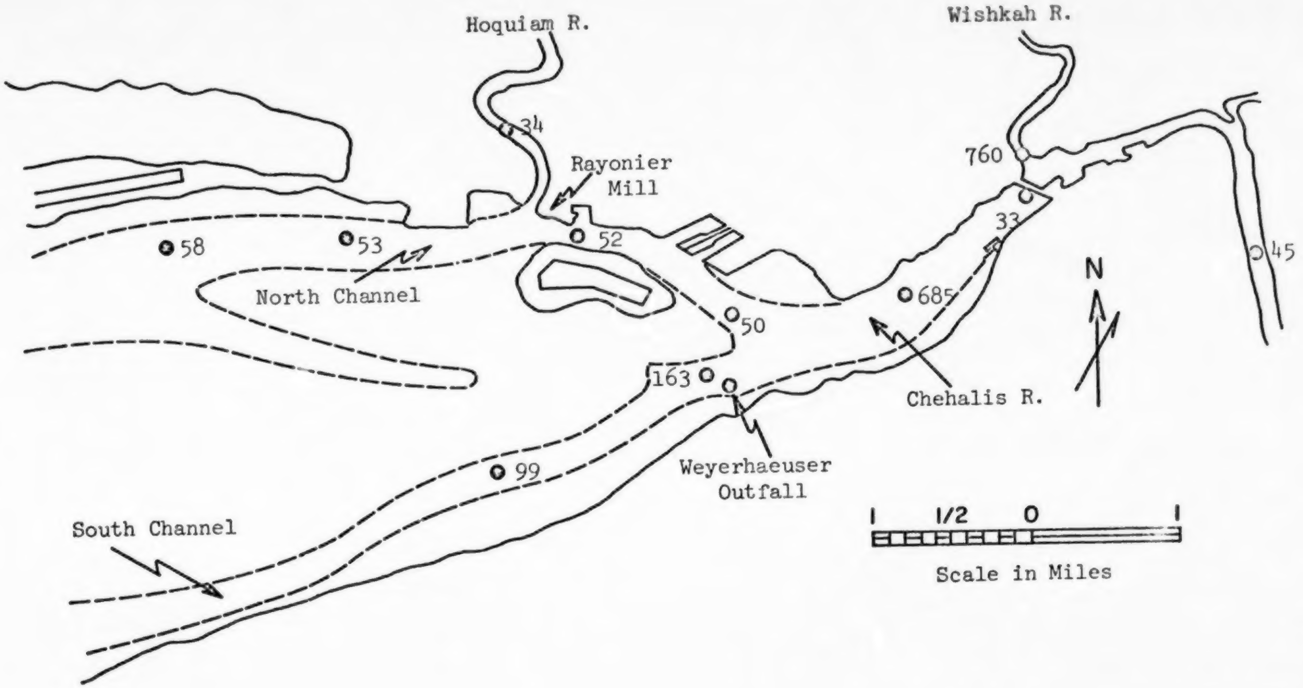

Hoquiam R.
Wishkah R.
34
Rayonier Mill
760
33
45
58
53
52
North Channel
50
685
N
163
Chehalis R.
99
Weyerhaeuser Outfall
South Channel
1
1/2
0
1
Scale in Miles

Figure 14

Grays Harbor Plot of D.O. (mg./l.) vs. Distance Downstream from Station 33 in Chehalis River. Data Taken from Long Trip Water Data on August 15, 1966 During Flooding or Slack Tides.

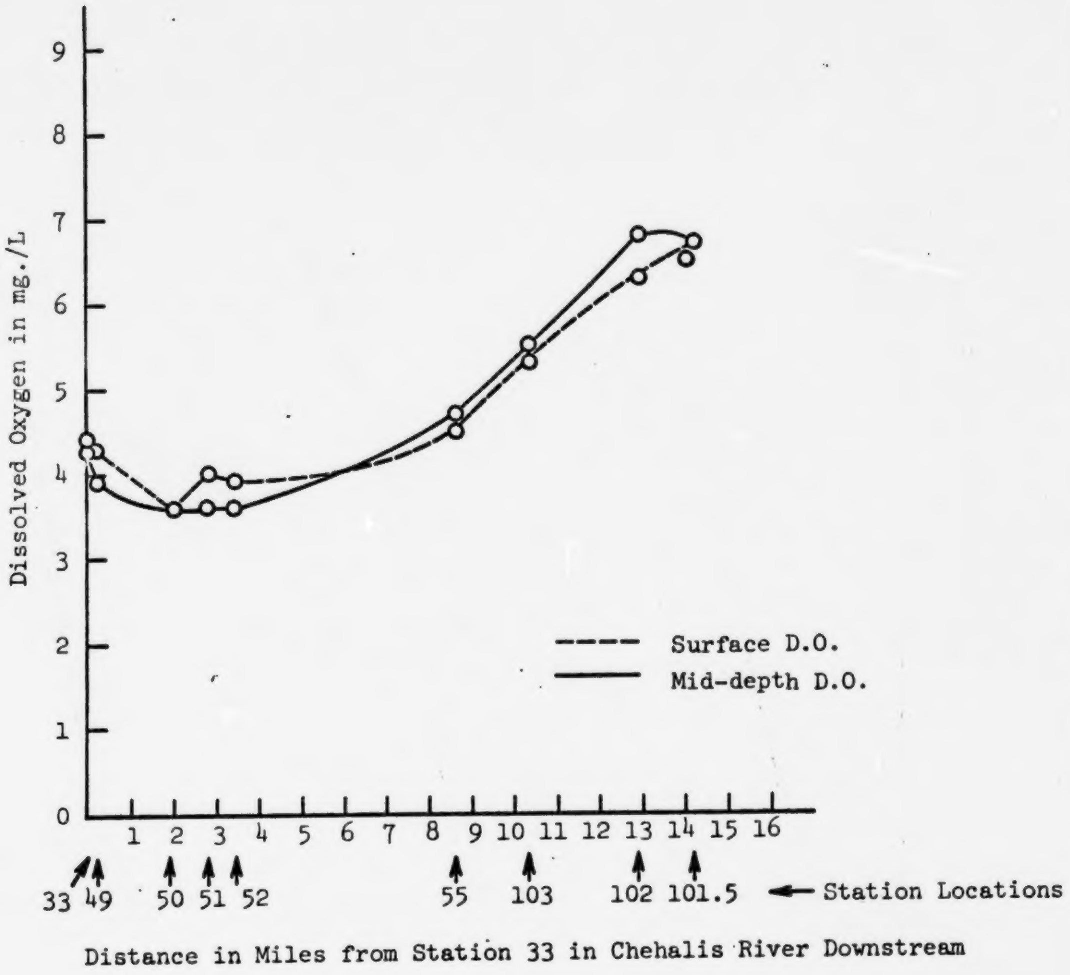


Figure 15

Cumulative Percent Frequency Distribution Curves of Dissolved Oxygen Concentrations at Stations 52, 53 and 58 for August-September of 1966

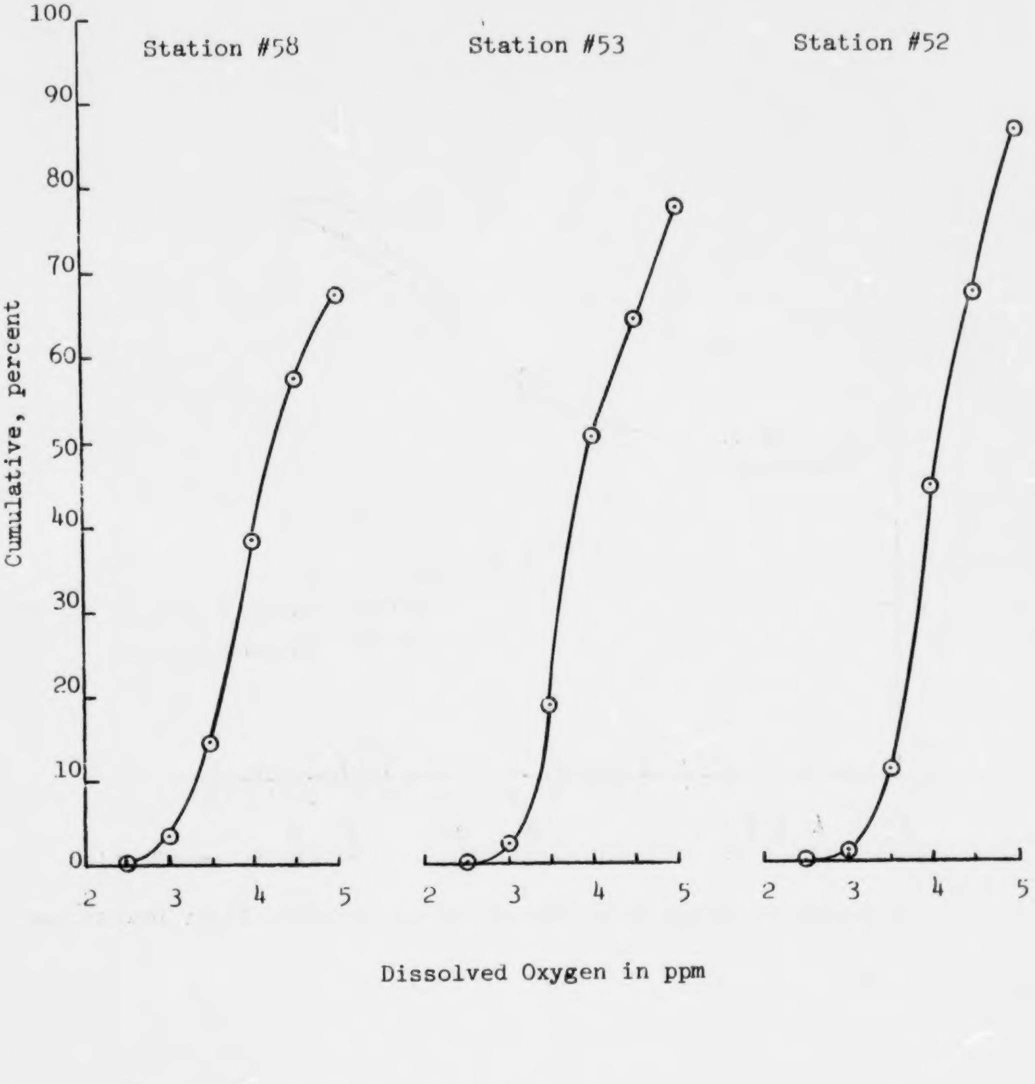
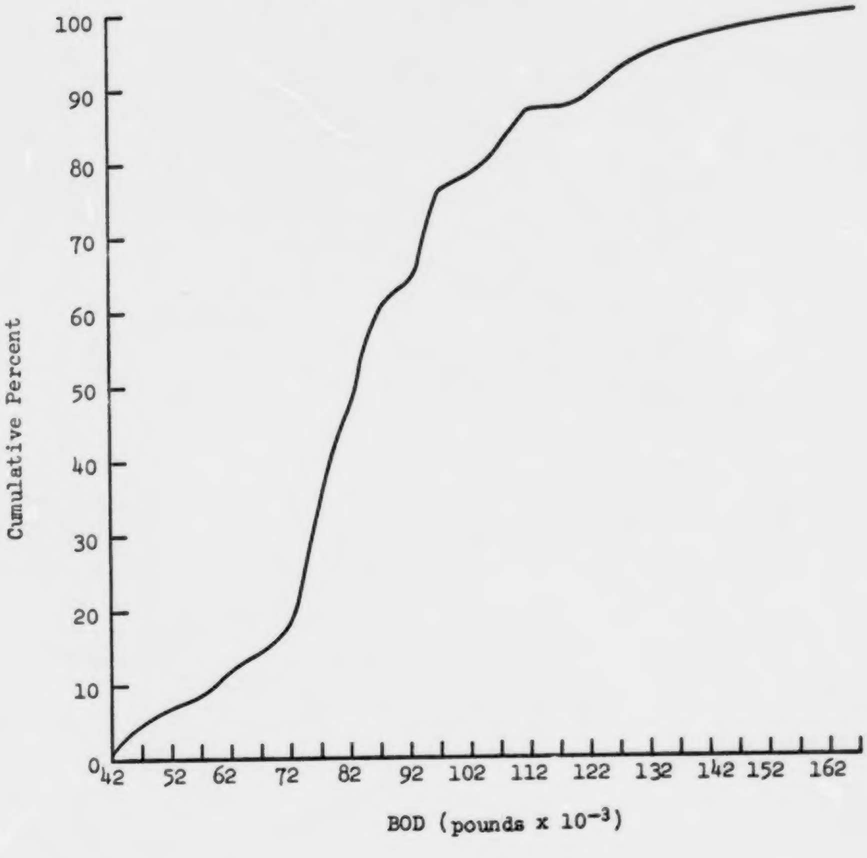


Figure 16

Cumulative Percent Frequency Distribution Curve of BOD (pounds x 10^{-3}) of Diffuser Outfall from Aug. 1 to Sept. 30, 1966



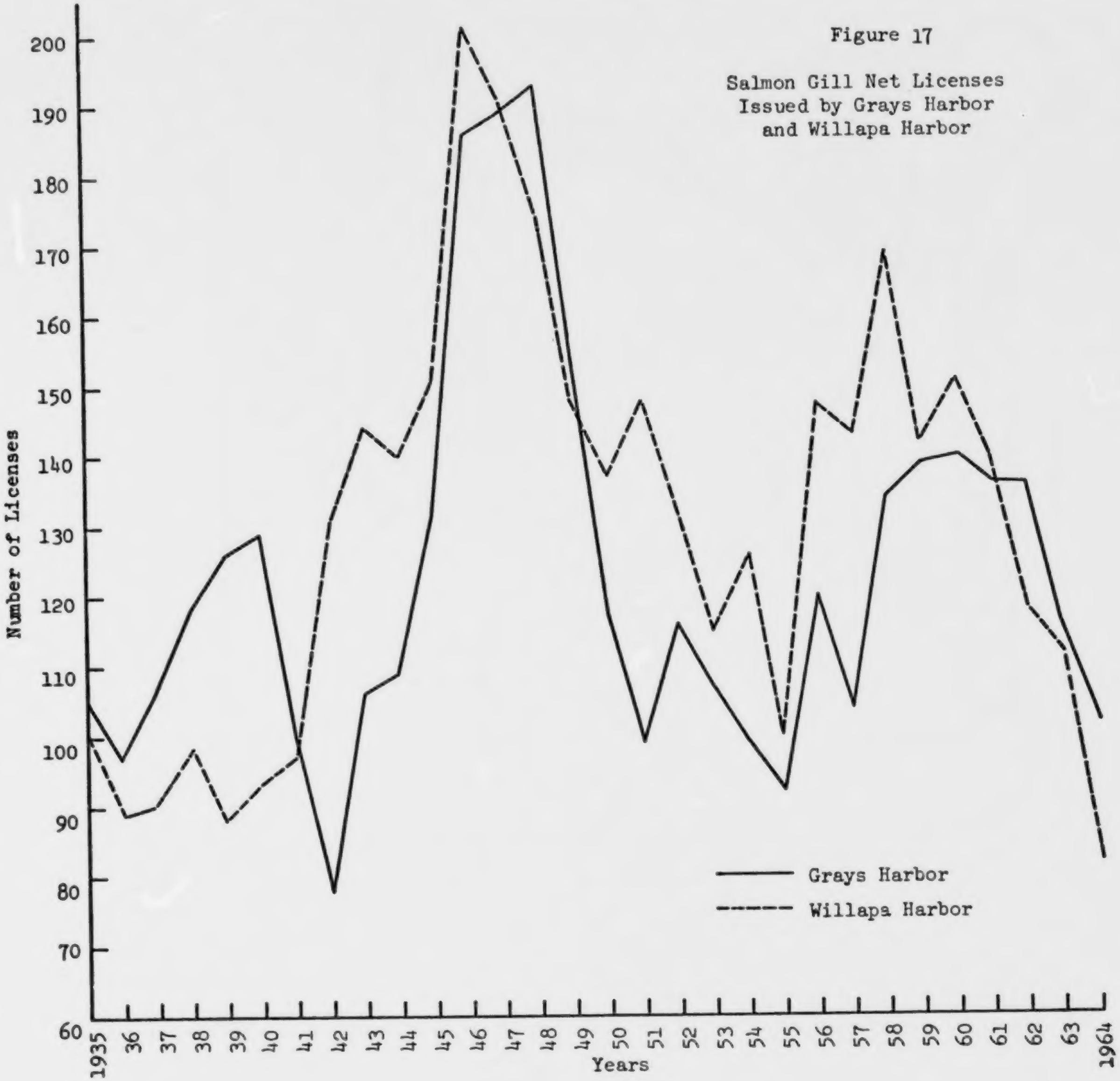


Figure 17

Salmon Gill Net Licenses
Issued by Grays Harbor
and Willapa Harbor

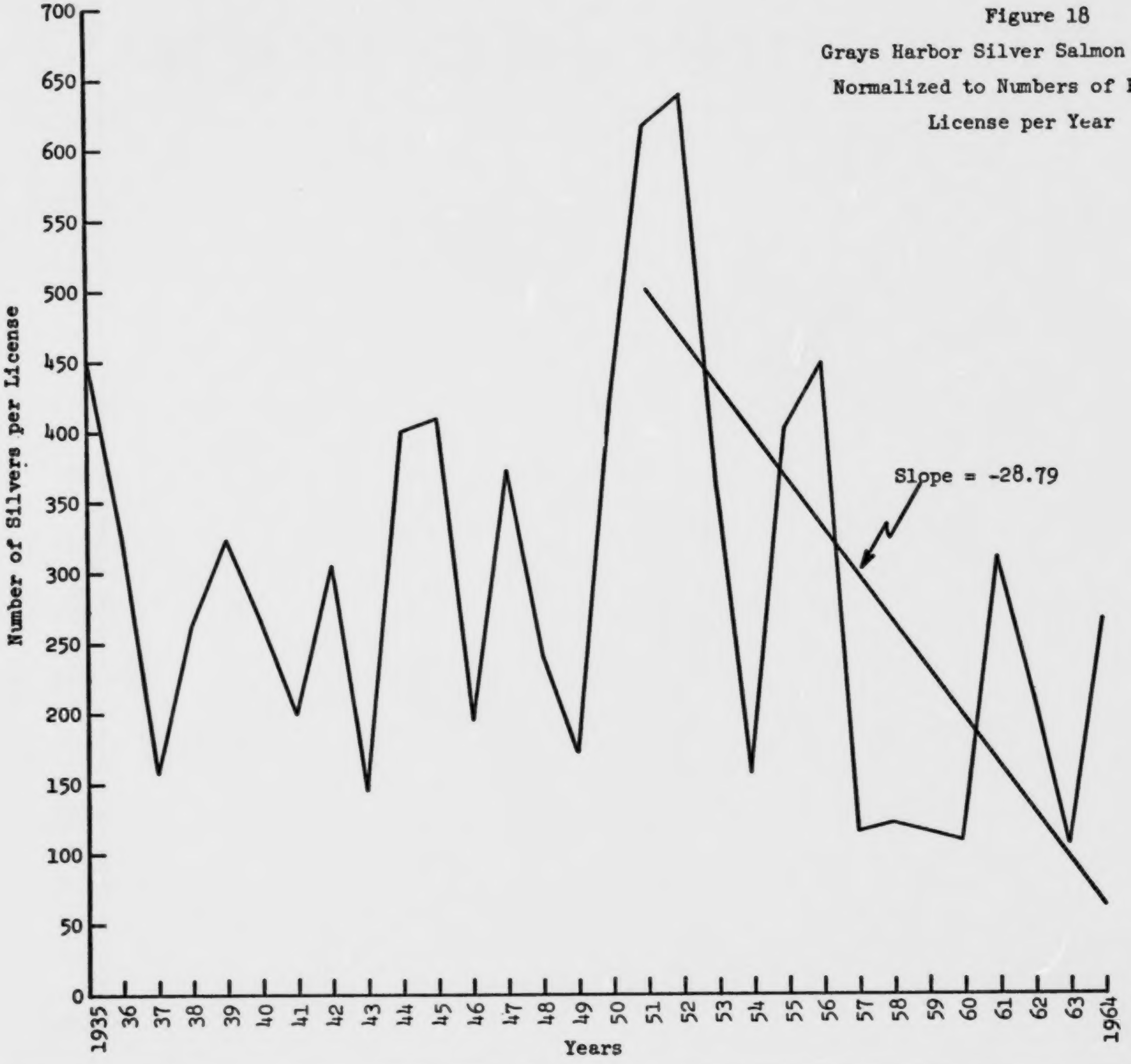


Figure 18

Grays Harbor Silver Salmon Landings Normalized to Numbers of Fish per License per Year

Figure 19

Willapa Harbor Silver Salmon Landings
Normalized to Numbers of Fish per License
per Year

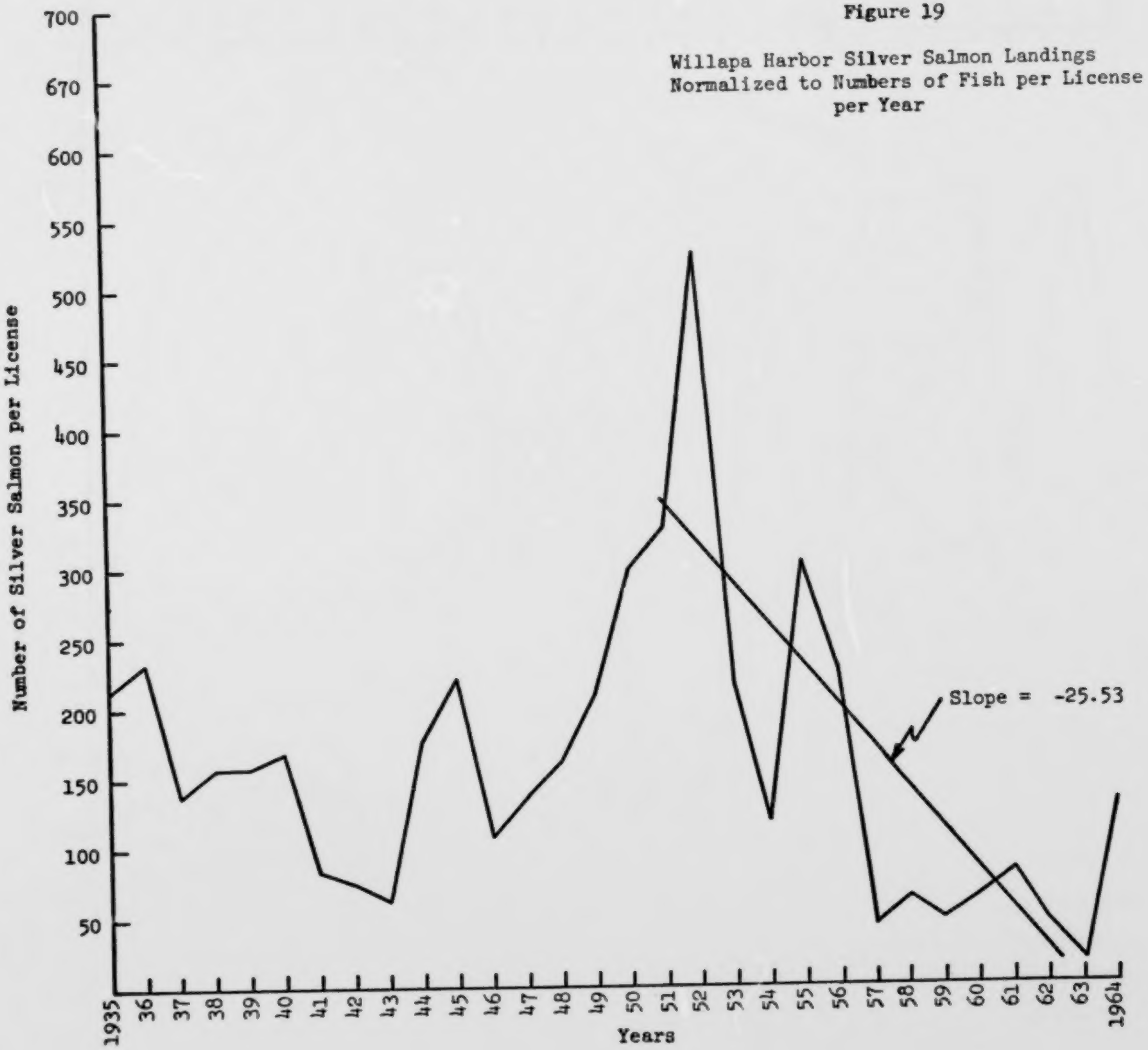


Figure 20

Grays Harbor Chum Salmon Landings
Normalized to Numbers of Fish
per License per Year

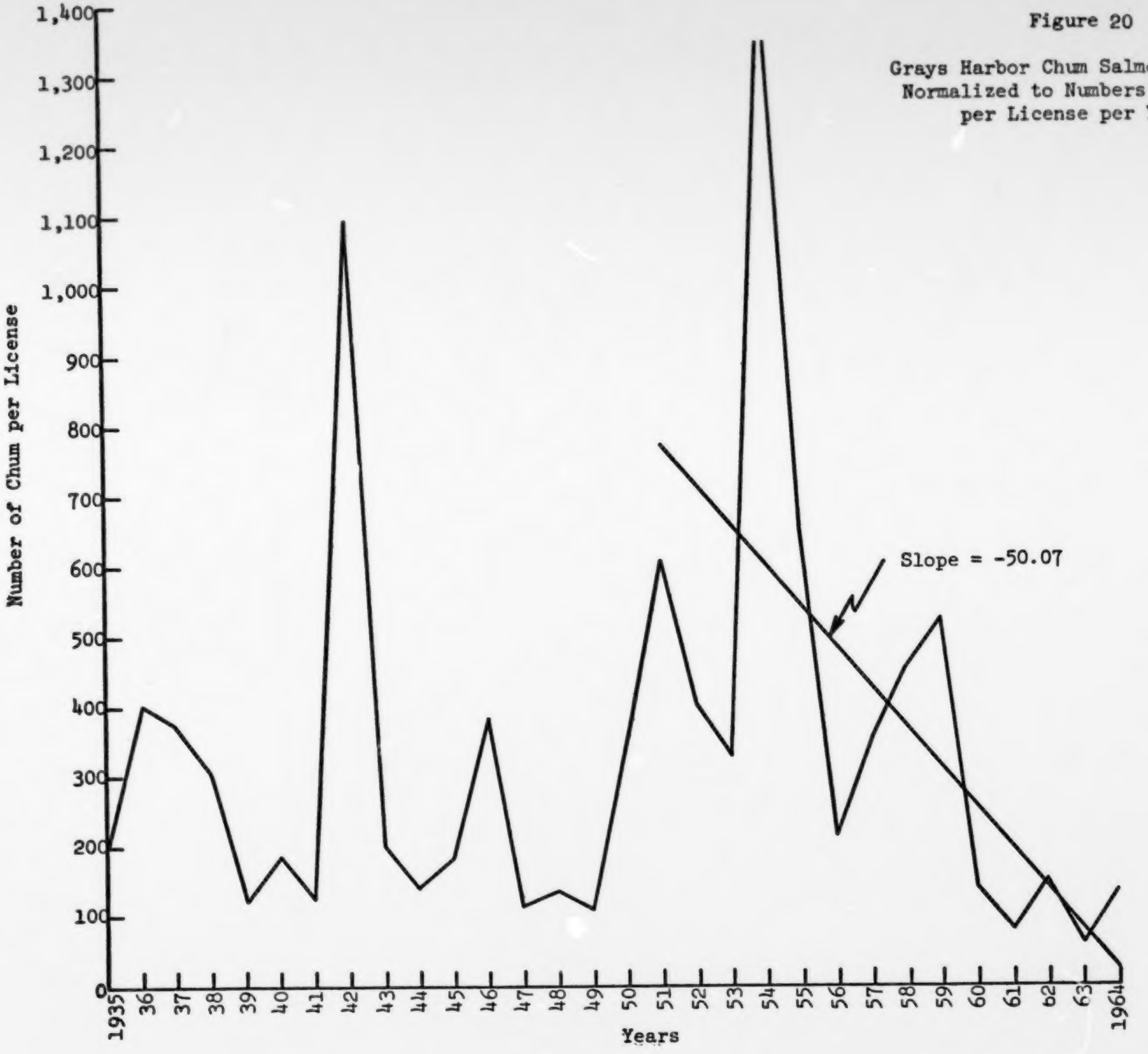
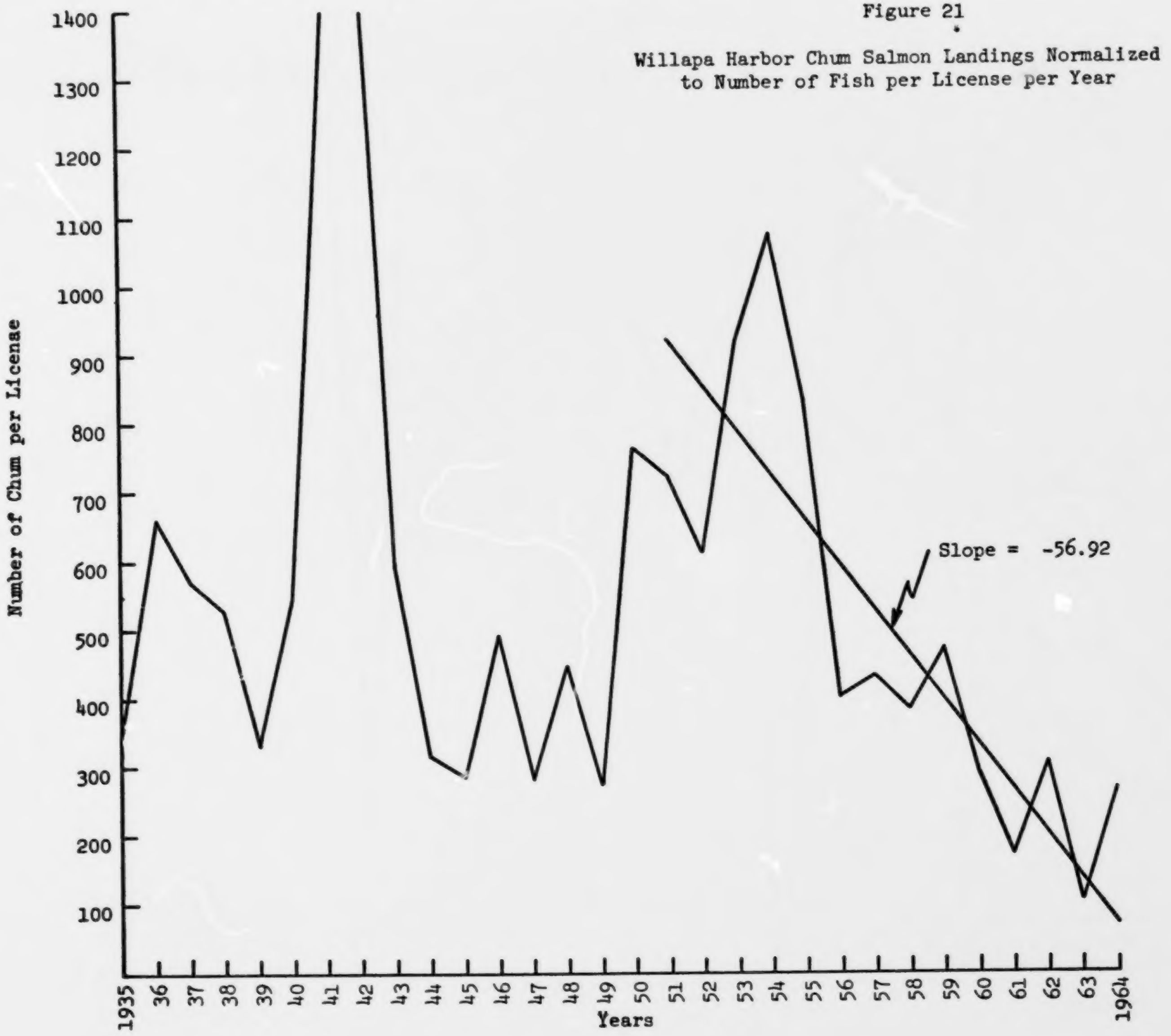


Figure 21

Willapa Harbor Chum Salmon Landings Normalized to Number of Fish per License per Year



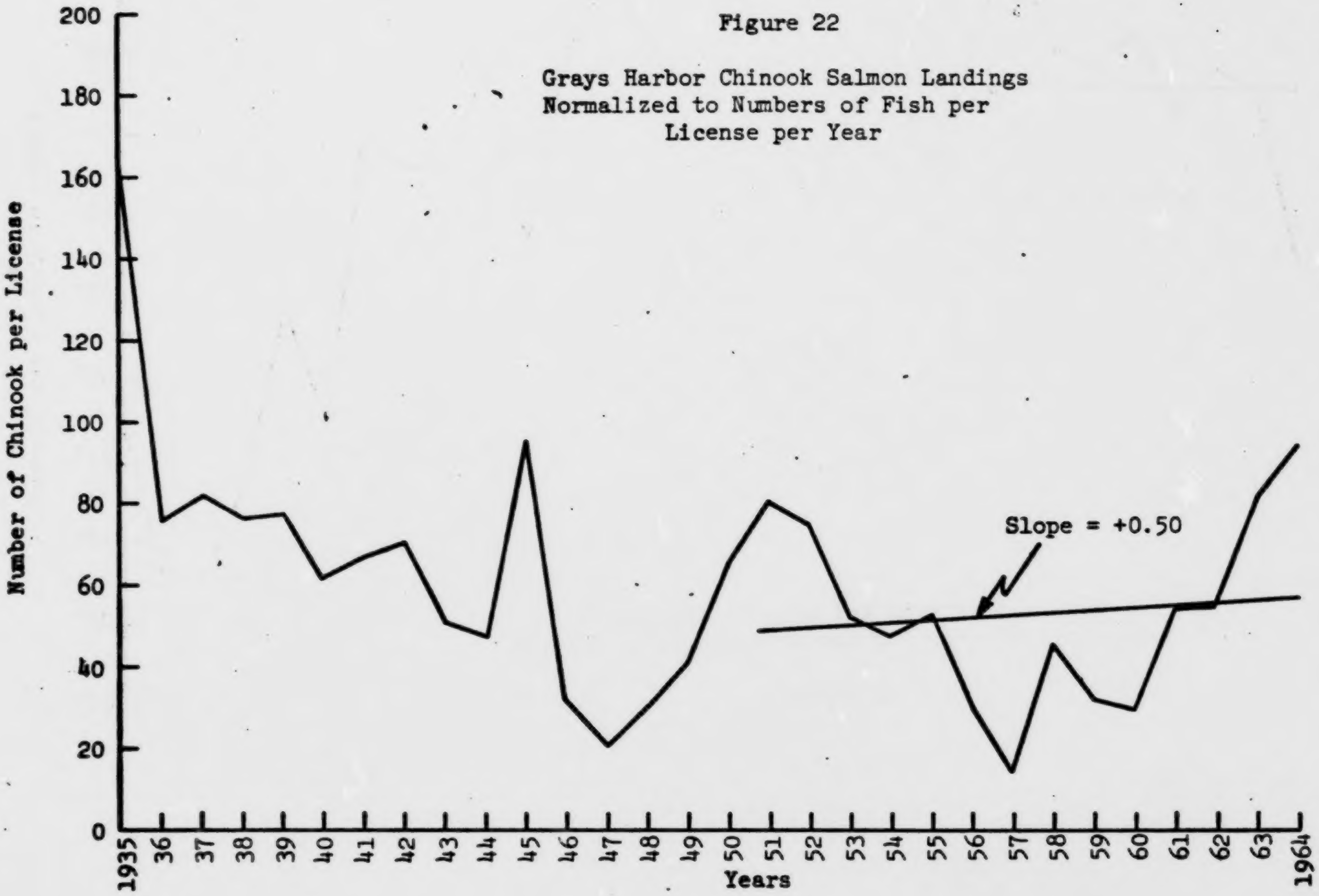
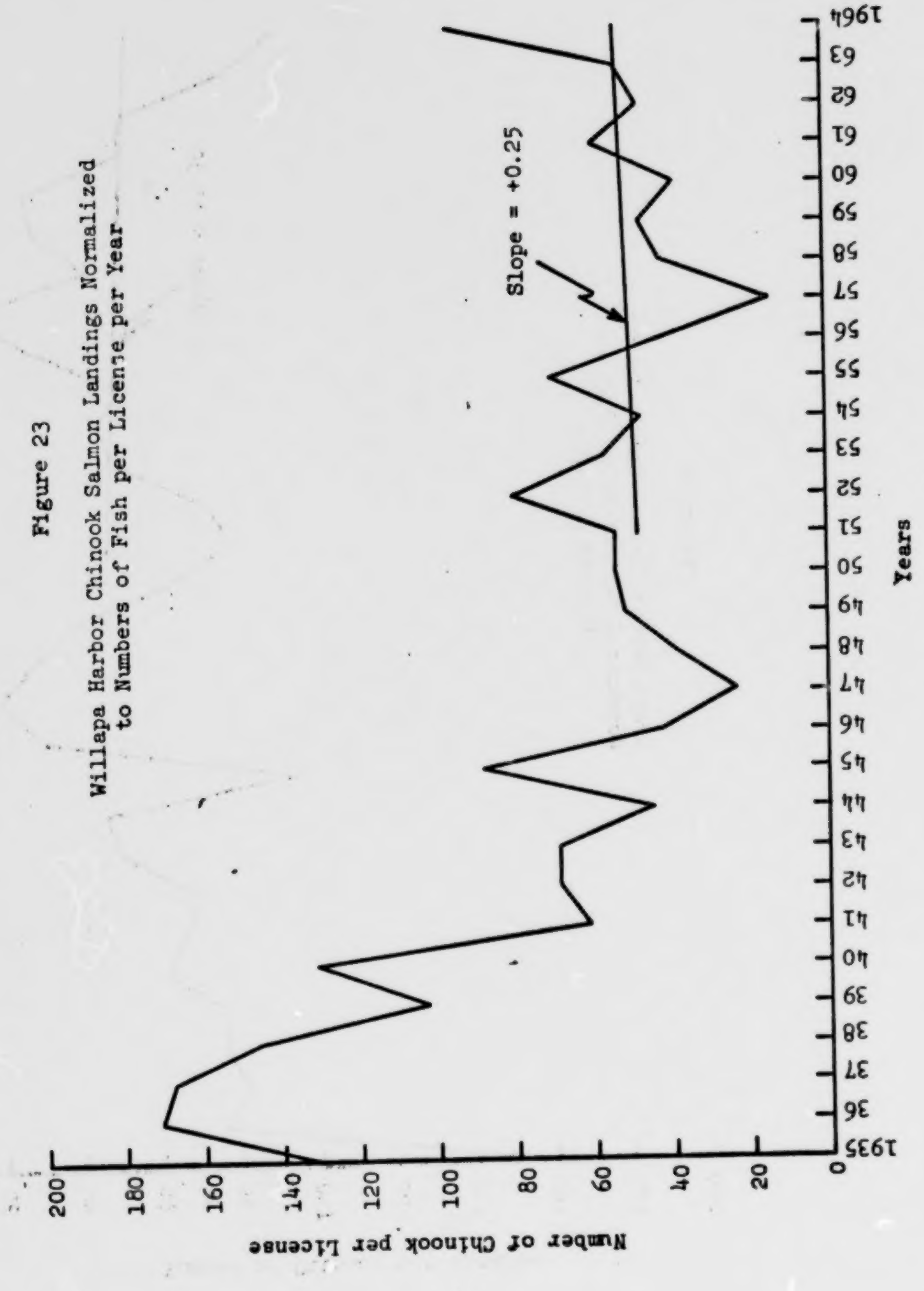


Figure 22

Grays Harbor Chinook Salmon Landings
Normalized to Numbers of Fish per
License per Year

Figure 23

Willapa Harbor Chinook Salmon Landings Normalized
to Numbers of Fish per License per Year



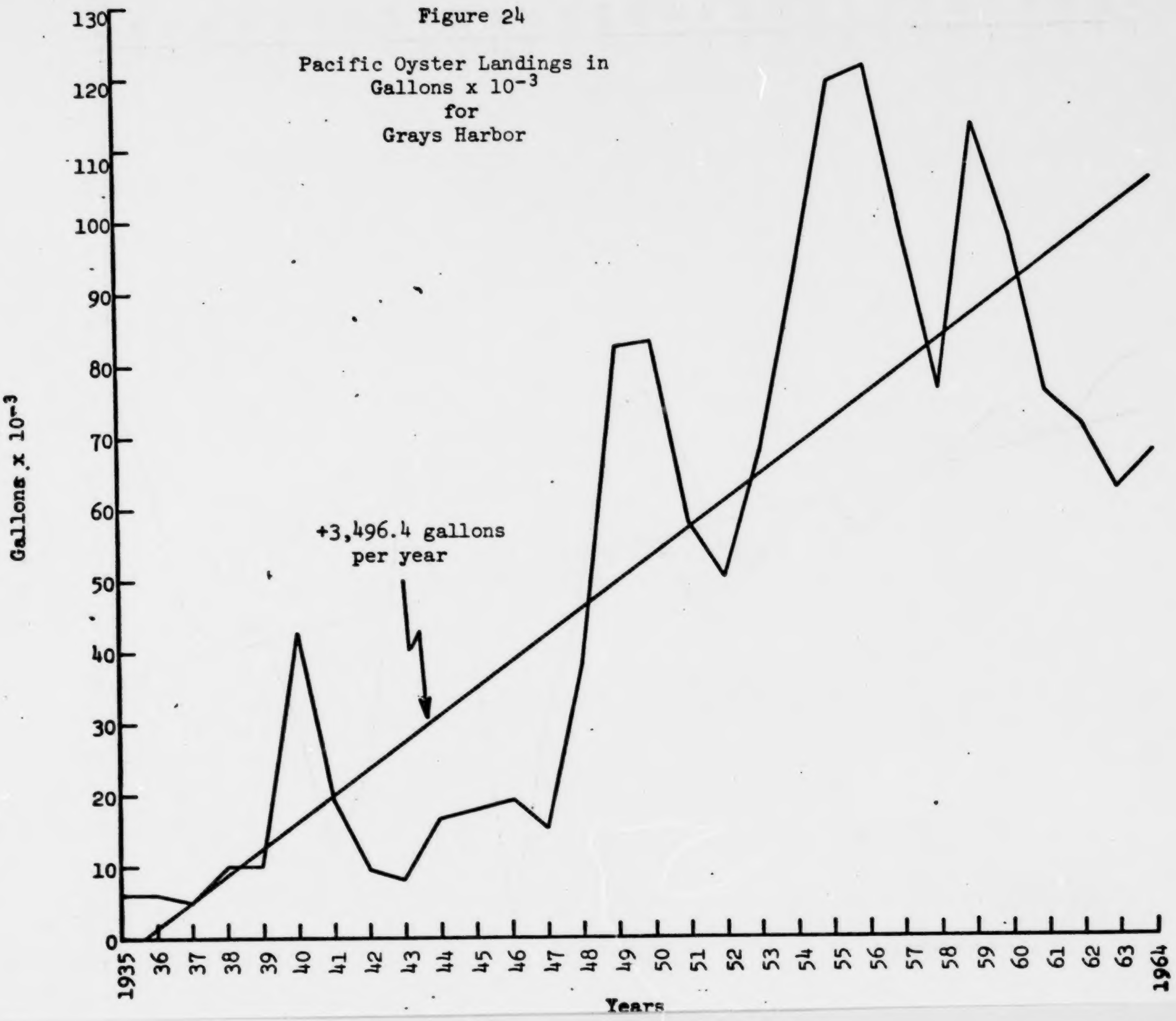
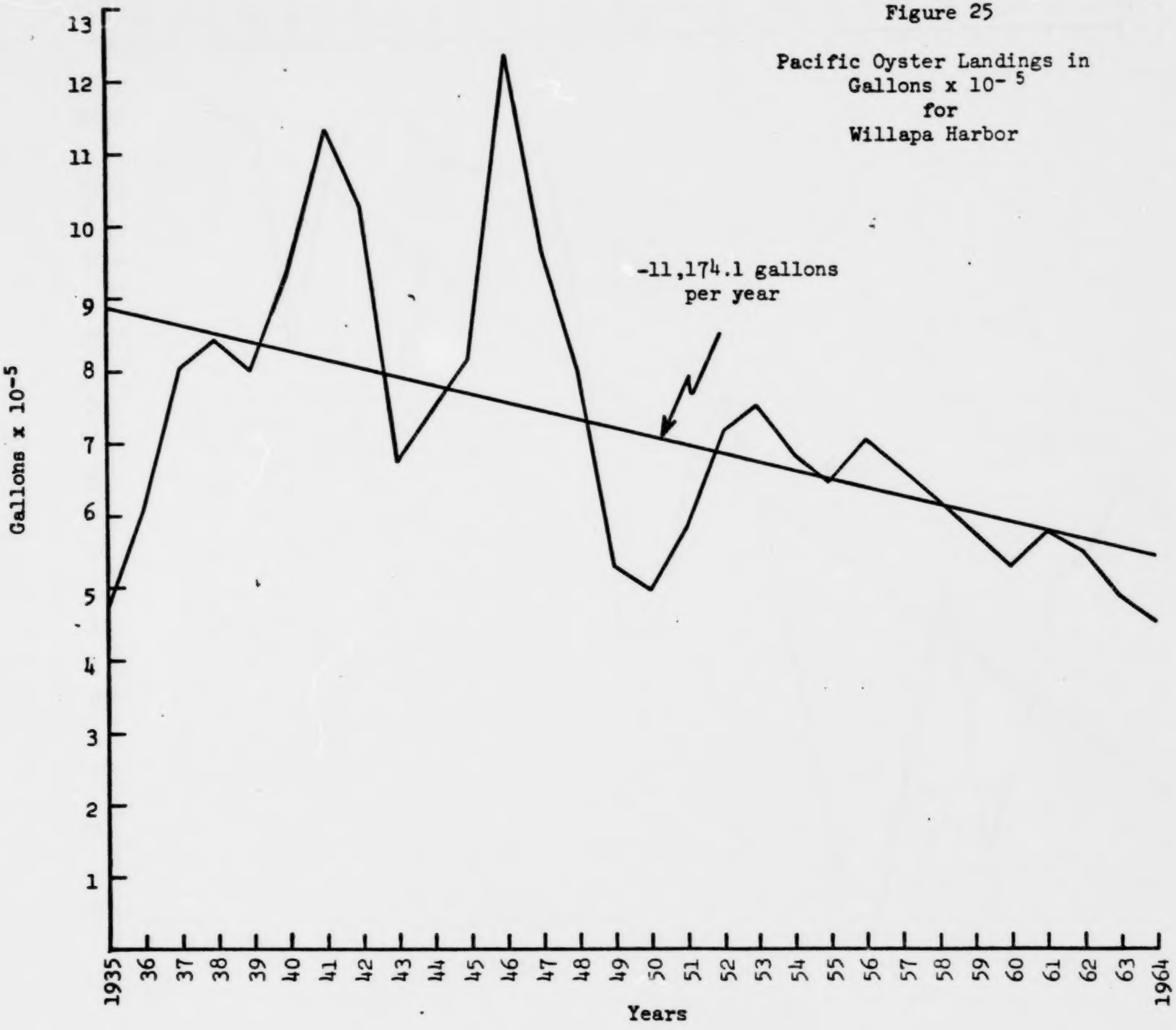


Figure 24

Pacific Oyster Landings in Gallons x 10^{-3} for Grays Harbor

Figure 25

Pacific Oyster Landings in Gallons x 10^{-5} for Willapa Harbor



February 2, 1967

G 10:1-5

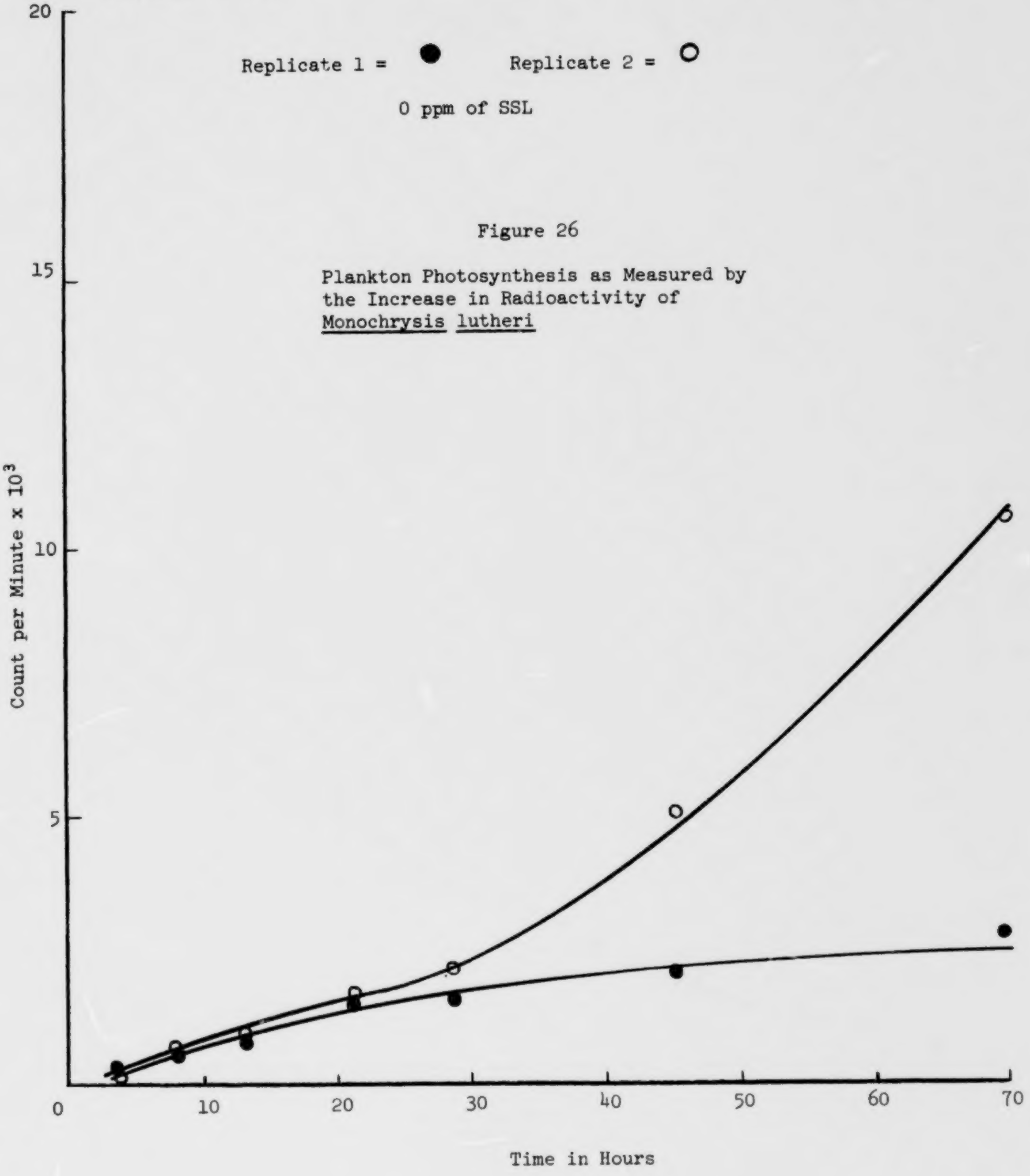


Figure 26

Plankton Photosynthesis as Measured by the Increase in Radioactivity of *Monochrysis lutheri*

February 2, 1967 G 10:1-5

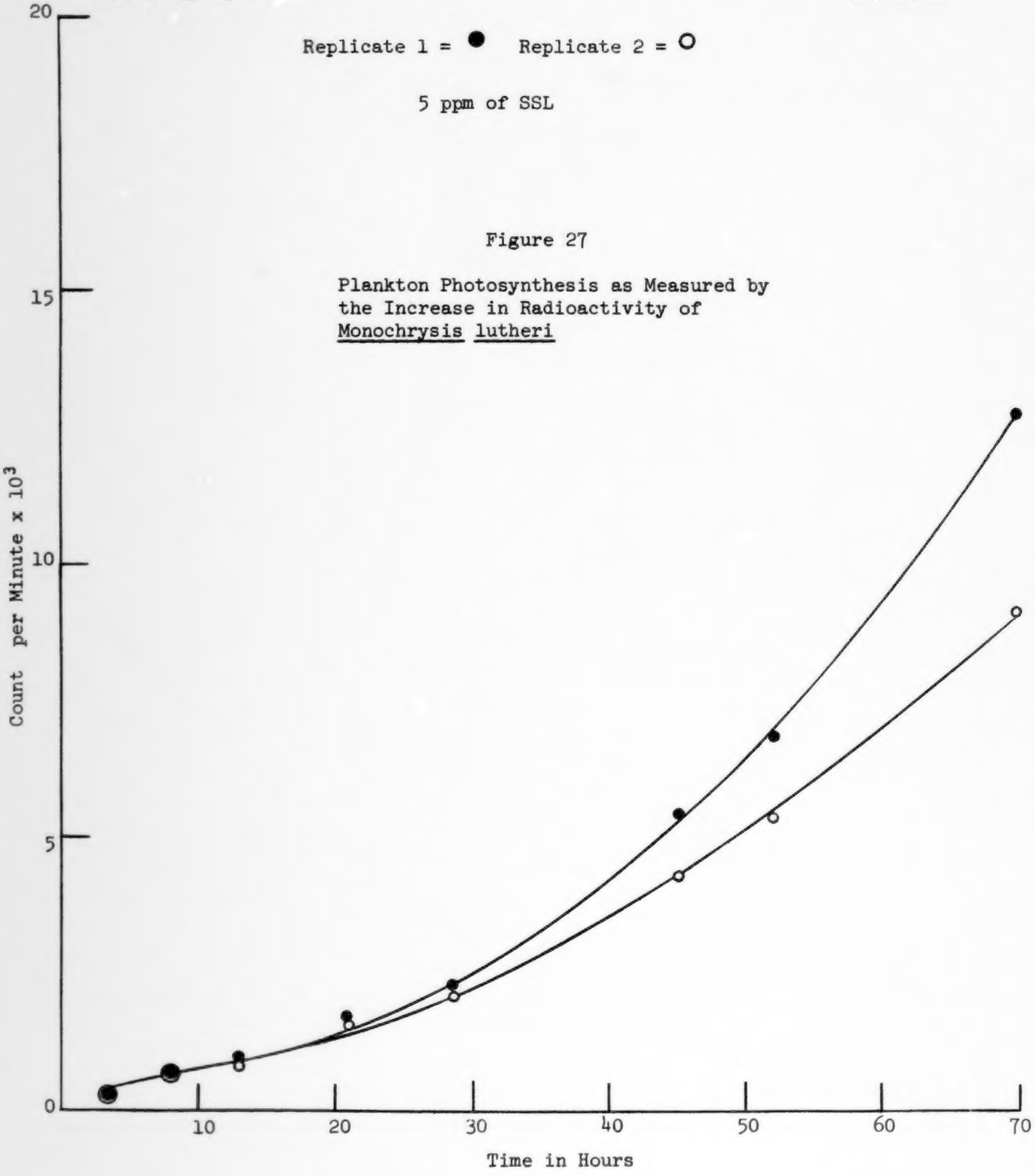
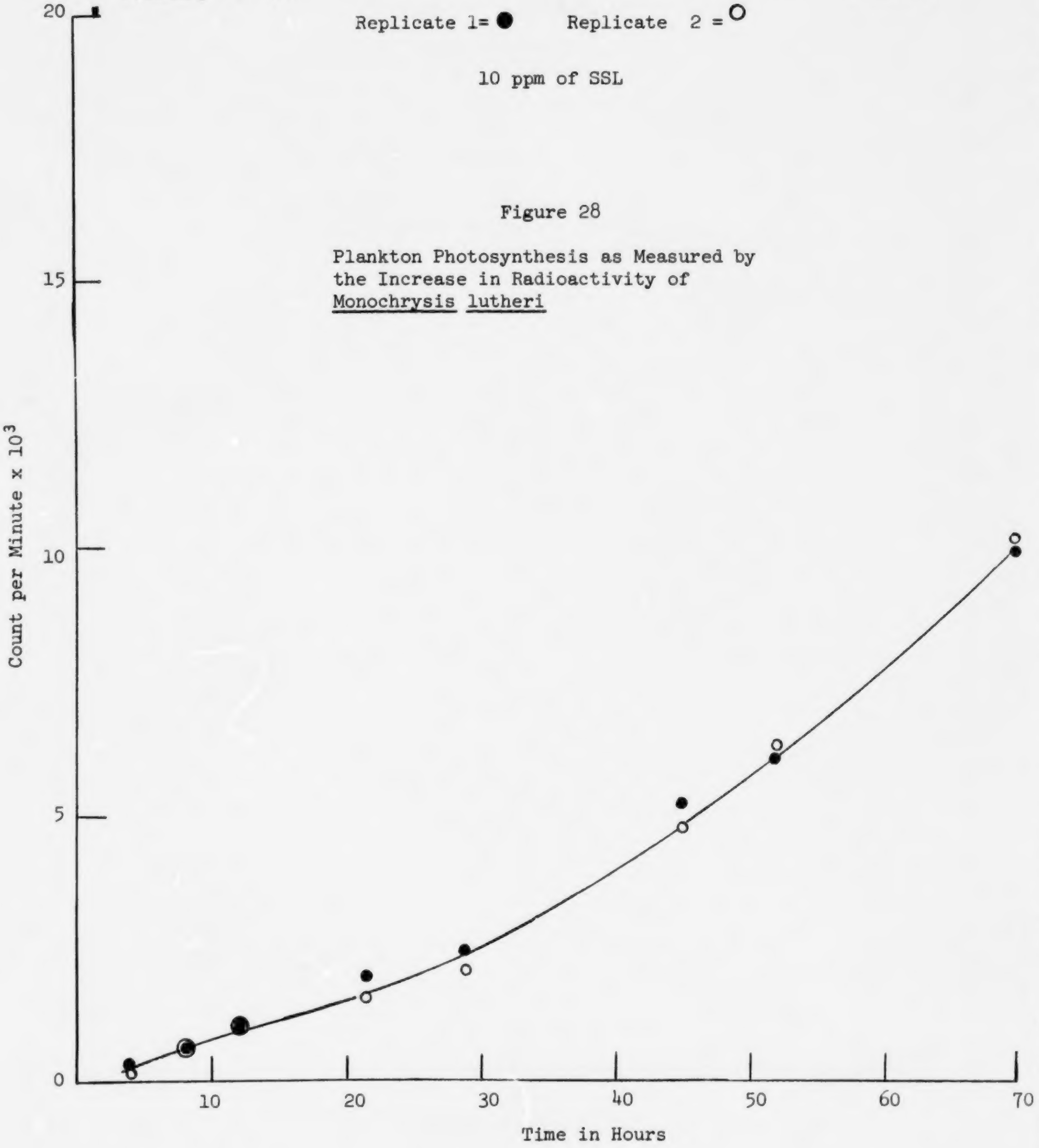


Figure 27

Plankton Photosynthesis as Measured by the Increase in Radioactivity of *Monochrysis lutheri*

February 2, 1967 G 10:1-5

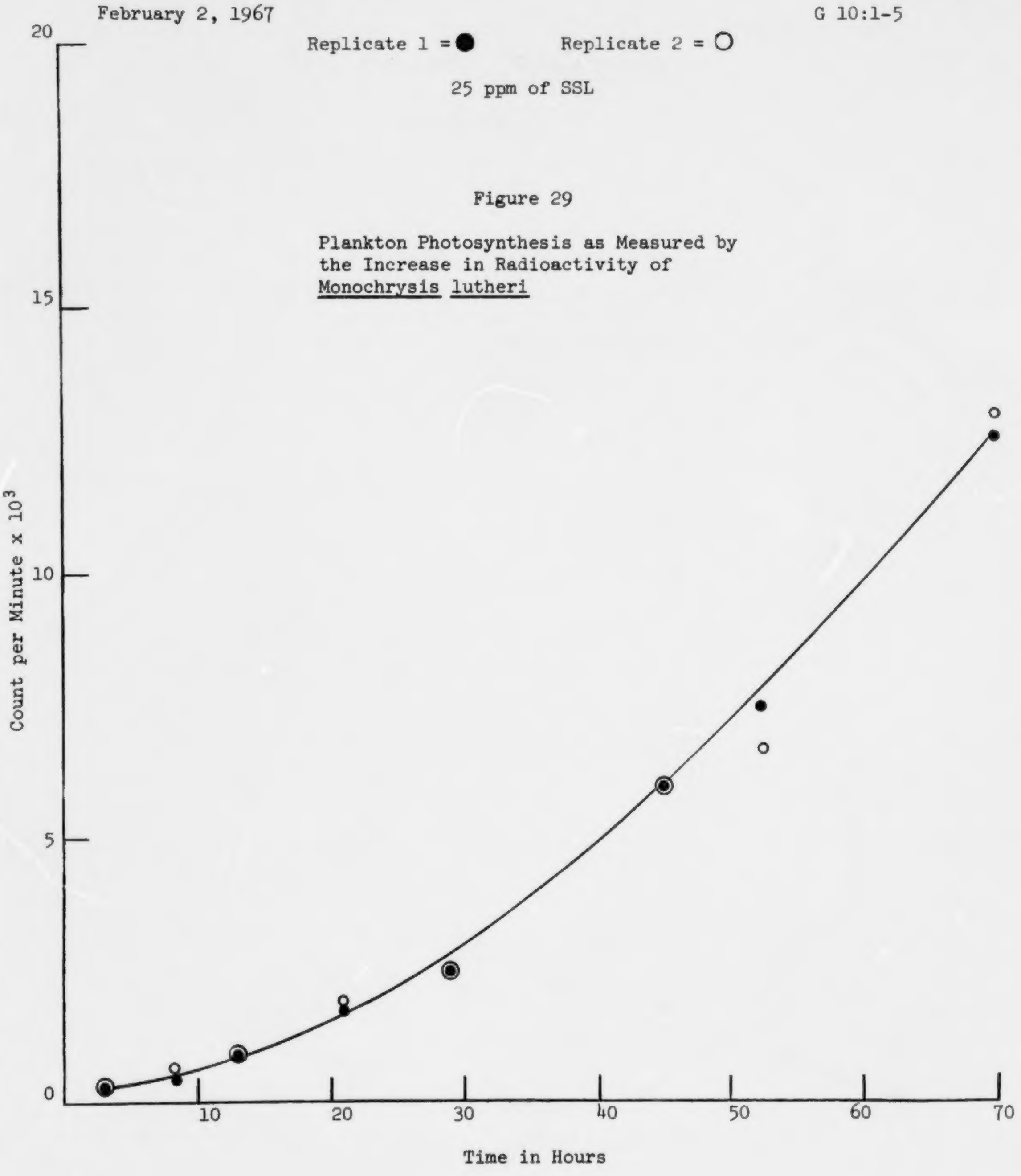


Replicate 1= ● Replicate 2 = ○

10 ppm of SSL

Figure 28

Plankton Photosynthesis as Measured by the Increase in Radioactivity of *Monochrysis lutheri*



February 2, 1967

G 10:1-5

Replicate 1 = ●   Replicate 2 = ○

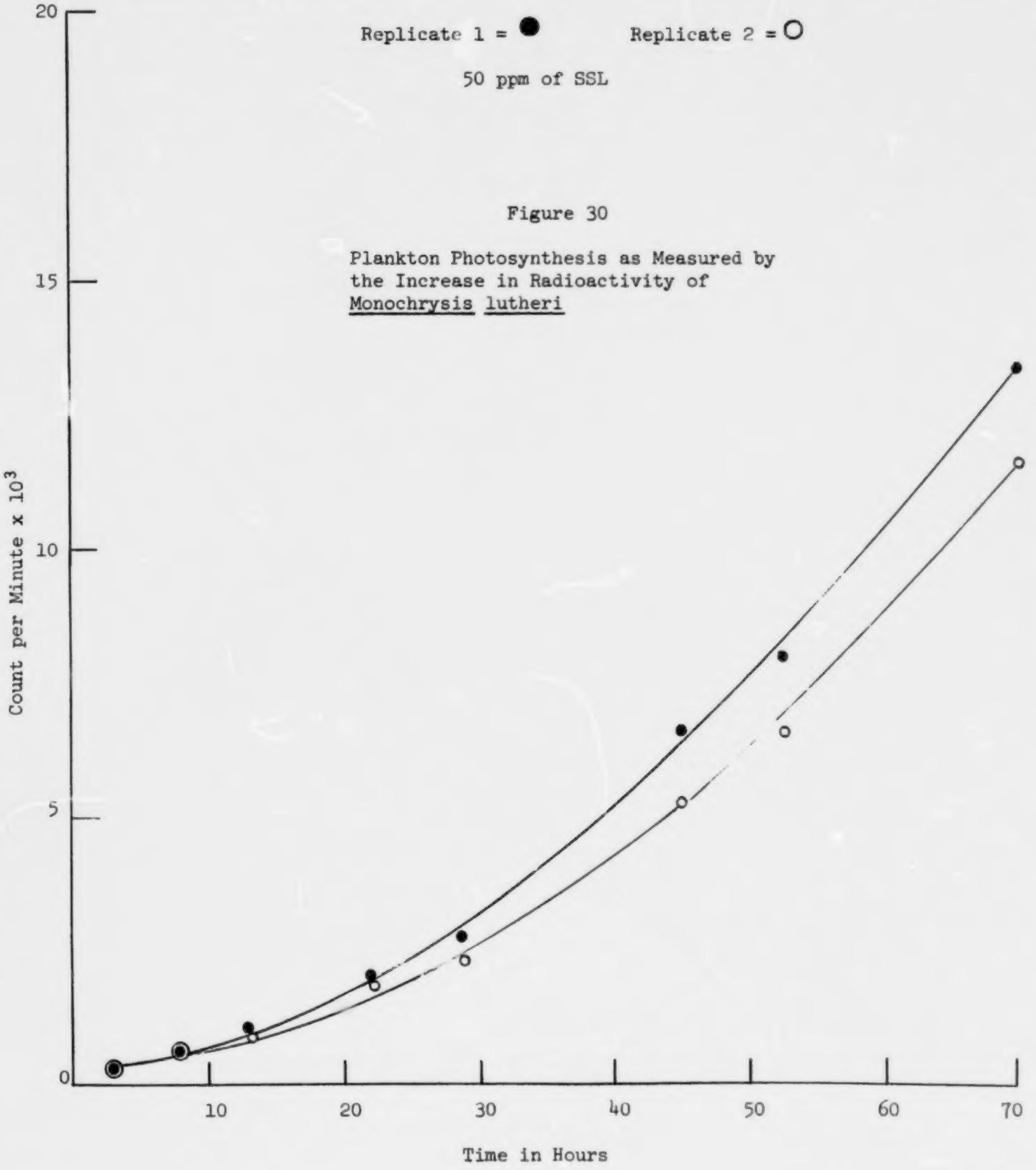
25 ppm of SSL

Figure 29

Plankton Photosynthesis as Measured by the Increase in Radioactivity of *Monochrysis lutheri*

February 2, 1967

G 10:1-5



Replicate 1 = ● Replicate 2 = ○

50 ppm of SSL

Figure 30

Plankton Photosynthesis as Measured by the Increase in Radioactivity of Monochrysis lutheri

February 2, 1967

G 10:1-5

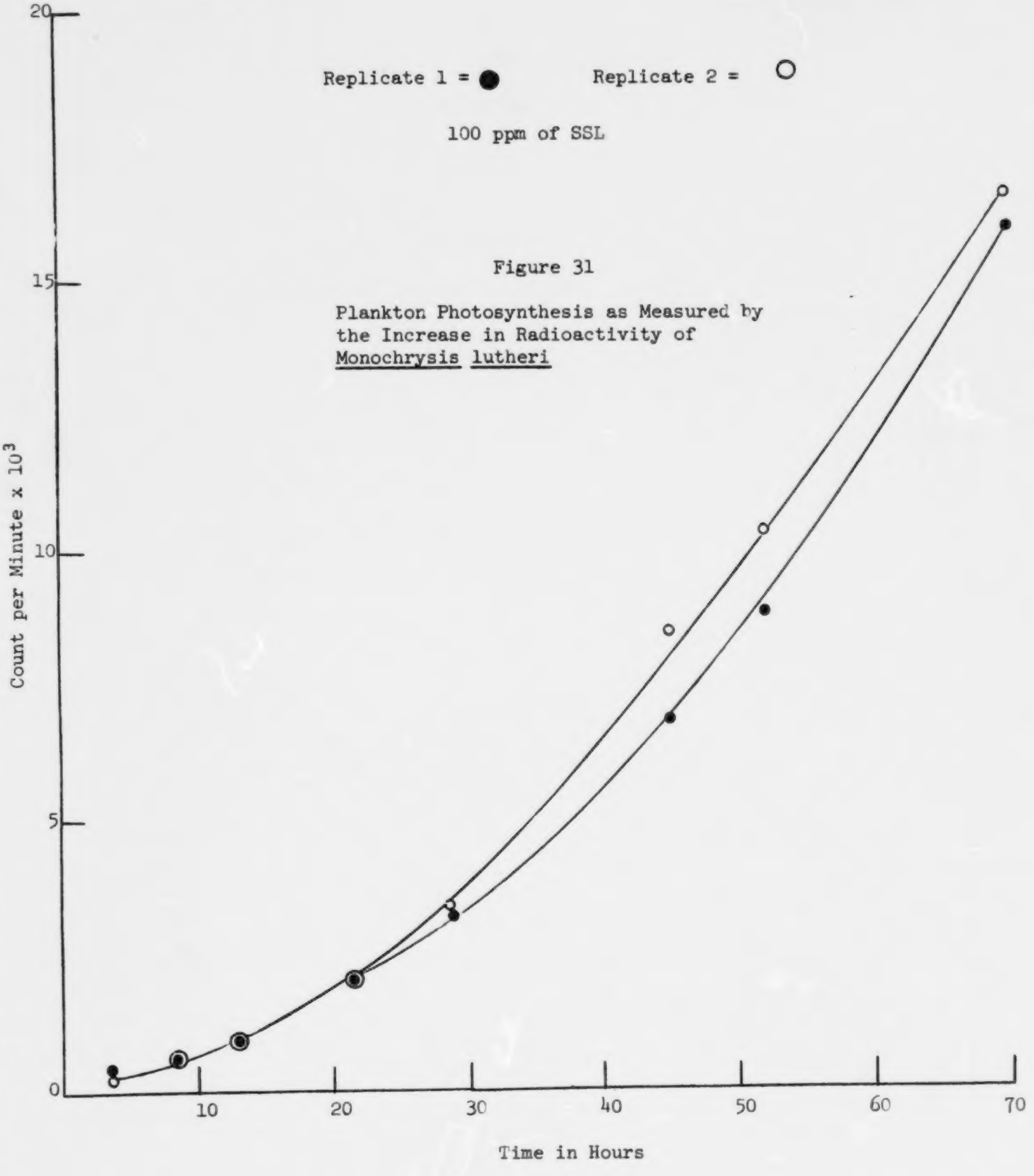


Figure 31

Plankton Photosynthesis as Measured by the Increase in Radioactivity of *Monochrysis lutheri*

February 2, 1967

G 10:1-5

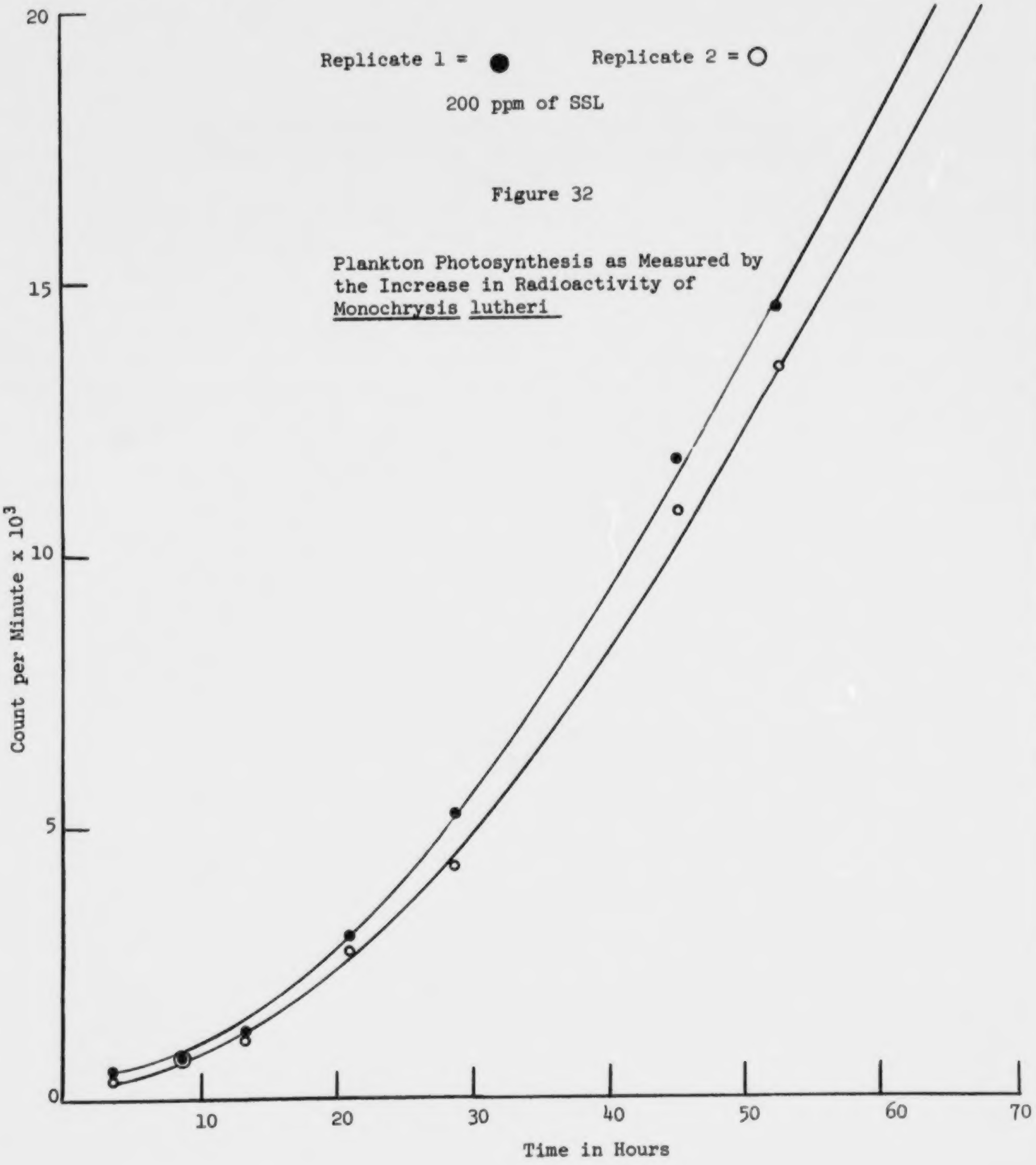


Figure 32

Plankton Photosynthesis as Measured by the Increase in Radioactivity of *Monochrysis lutheri*

TRENDS IN THE CHINOOK, SILVER, AND CHUM COMMERCIAL FISHERY IN THE GRAYS HARBOR AND WILLAPA BAY AREAS
1936-1965

BY

MAX KATZ, PH.D.
BIOLOGICAL CONSULTANT
MERCER ISLAND, WASH.

Grays Harbor Salmon Catch Trends
1935-1964

by

Max Katz
Biological Consultant

Three species of Pacific salmon are represented in the commercial salmon catches in Grays Harbor. These are the chinook salmon, Oncorhynchus tshawytscha, the coho or silver salmon, O. kisutch and the chum salmon, O. keta.

Chinook

The chinook salmon is the most esteemed of the Pacific salmon by the public and is the fish that is generally conjured in the mind of a person when he discusses salmon. It is the largest of the Pacific salmon; twenty pounds is a typical average weight for an adult chinook salmon although specimens up to seventy pounds have been taken by Washington sportsmen. The chinook readily takes fishermen's lures and is usually sought during the long pleasant days of summer; hence it is a favorite of sportsmen and a large recreational industry has developed to accommodate this interest.

The chinook is, of course, of great value commercially and is canned, sold fresh, and various delicacies are prepared from this fish. There is a ready market for this fish and a high wholesale price does not limit its marketability.

In addition, the chinook is an easy fish to raise in a hatchery and is a far more economical fish for hatchery cultivation than is the coho salmon. The chinook comes into its home stream usually in September and October while the water temperatures are still fairly warm. They produce a large number of eggs per female and hatch late in the winter or early in the spring, i.e., February and March. They are fed until April and May and released to migrate to the estuary and in turn to the ocean. A conservation agency with a salmon hatchery program would be happy if they could devote their entire program to chinook culture only. This would mean that they could close operations in April or May, after releasing their fish, and not reopen until that fall. They would be producing a large, valuable fish, at a minimum expenditure.

Unfortunately, this cannot be done because this would involve laying off a large part of the hatchery crew for a period of four to five months. The pay rate of a hatchery man is not high, and most of the crew would find other permanent employment. The costs involved in having a large hatchery installation standing unused is considerable in terms of dollars and public relations. The state conservation agencies are obligated, therefore, to cultivate the silver salmon in order to retain their working force and to utilize their facilities. Although the silver salmon is a very desirable sports and commercial fish, the economics of their culture suffers in comparison with that of the chinook salmon. First, the adult silver is an eight to ten pound fish as contrasted to the twenty pound or larger chinook. The necessity of collecting sufficient silver eggs to utilize the hatchery facilities reduces the space available for chinook eggs. The silver eggs hatch somewhat later than the chinook eggs, and the fry must be retained in the hatchery for an entire year before they can be released. The conservation agency, because of the force of circumstances, pays a relatively large price for the fish that is a second choice.

In nature, the chinook is characteristically found in the larger streams and is adapted to making long migrations of over a thousand miles to its natal streams. It spawns typically in the larger streams although in common with most salmonids will establish in streams that are atypical. In the state of Washington, the fall runs migrate into fresh water in late August, September, and early October. Their spawning is usually completed before the winter high-water periods. Their redds which are made during low-water periods are usually well covered by water during the high flows of the winter, and are somewhat protected from scouring floods. Their residence in fresh water is brief and they migrate into the estuaries and into the ocean by late spring, thus avoiding the low-water and high-water temperatures of the summer season. Because they avoid most of the ecological disturbances found by the other species of salmon, their populations are characterized by a uniformity in number which is not typical of the other species of Pacific salmon, if it were not for man's activities.

On the other hand, because they prefer the larger streams which are characteristically developed by man, i.e., dams, irrigations diversions, water supply and waste disposal facilities, they are in a steady decline throughout the state because of habitat loss (Table 1, Figure 1).

Silver Salmon

The silver or coho salmon is regarded by the sportsman and the coastal commercial fishermen as the second important of the salmonids. It is a smaller fish than the chinook and averages eight to ten pounds at maturity. The adult fish enter their home streams somewhat later in the fall than do the chinook. Their upstream migration starts usually in October - frequently after the first heavy freshet of the fall, and may last in the various streams until December and January. Whereas the chinooks will migrate upstream in the early fall when water levels are low, silvers migrate under "high-water conditions". The silver is typically a fish of the smaller rivers and creeks although they use the large rivers in their migration into their smaller spawning streams.

Table 1. Numbers of chinook, chum, pink, silver salmon landed in the State of Washington from 1935-1965

Year	Chinook	Chum	Pink	Silver
1935	563,084	844,034	5,824,689	1,902,043
1936	610,340	1,036,734	24,681	1,118,497
1937	652,398	982,536	5,086,288	1,069,437
1938	434,699	1,008,660	7,893	860,203
1939	468,545	441,186	4,067,180	1,225,531
1940	588,119	741,179	25,937	1,070,919
1941	656,811	1,183,723	2,021,027	1,255,930
1942	607,716	1,197,274	1,607	583,607
1943	487,020	562,982	972,944	870,974
1944	497,234	396,248	4,287	698,634
1945	546,127	520,538	5,895,111	1,068,122
1946	643,433	1,513,781	222	606,199
1947	637,178	706,837	9,372,326	1,354,799
1948	572,846	1,100,183	304	1,259,747
1949	507,761	537,078	7,604,529	1,247,800
1950	480,408	1,083,096	10,042	1,407,265
1951	594,789	1,043,102	5,699,618	1,323,162
1952	662,082	930,813	1,914	1,852,245
1953	630,394	506,214	6,052,519	1,269,921
1954	570,145	739,500	294	722,377
1955	651,221	375,087	5,207,548	1,043,054
1956	519,330	200,328	928	1,433,520
1957	586,189	210,492	3,183,773	1,103,264
1958	481,645	559,547	5,116	994,852
1959	374,999	519,384	2,616,384	988,199
1960	283,282	206,159	2,254	340,685
1961	371,065	174,459	753,412	1,035,087
1962	329,832	238,487	6,680	1,142,224
1963	396,543	317,973	6,301,706	880,967
1964	349,419	285,612	10,262	1,127,685
1965	317,403	210,667	729,052	1,495,976

Silvers are well-adapted to hatchery conditions and are raised in great numbers in the various hatcheries. Although they are less economical to raise in terms of dollars expended per pound of adult fish, they do help to utilize the capacities of the hatcheries which otherwise would be empty for several months. They are retained in the hatchery, their natal spring, through the summer, fall and winter until early the next spring when they are released.

Under natural conditions, the coho spawn in the smaller rivers and creeks and the small fish spend the entire year there. These species are therefore subjected to the entire range of ecological changes resulting from the seasonal changes. If the summers are warm and dry and the level of the streams drops, the number of coho fingerlings produced is at a minimum. If the summer is cool and with considerable rainfall, the production of the fingerlings is several times larger. During their stream residence, they are subjected to all of the man-made ecological changes and are affected by water quality changes caused by farming, logging, road construction, waste disposal, fresh-water sports fishery, insecticide spray programs, etc. In the hatchery, because of their long stay, they are subject to diseases which are sometimes difficult to control, nutritional deficiencies sometimes imposed by inadequate diets, warm summer temperatures, hatchery accidents, and interference with hatchery water supplies by upstream users.

Of all of the species of Pacific salmon, with the exception of the Puget Sound pink salmon which appear only every other year, the coho populations are most apt to be affected by ecological variables in their early life history. This is substantiated by Table 1, and Figure 3, in which the catches are seen to fluctuate several fold in magnitude from year to year.

Chum Salmon

The chum salmon is the third of the species of Pacific salmon of importance in the Grays Harbor and Puget Sound area. The chum as an adult averages about 8 to 12 lbs. The knowledge of its life history and its ecological requirements are fragmentary as compared to that of the other Pacific salmon. One important reason for the lack of knowledge is that this species has extremely great variations in its life history for area to area or even in the same watershed. For example, a single small stream may have two different races of chum, one of which will spawn in September and the other in December. The spawning requirements of various races vary much more than do the other species of Pacific salmon.

In general, however, the chum salmon is a late winter spawner (with marked and consistent exceptions) and is usually the last of the salmon species to move into fresh water. In the Grays Harbor area, however, the chums come into the Chehalis system after the chinooks and before the silvers - usually in late October and early November. The chums make typically a short migration into the Chehalis and its major tributaries and deposit their eggs soon after their entrance into the streams. Yet, in the Satsop, chums make a long migration - at least up to the East Fork of the Satsop. They usually spawn in the main river and in the lower tributaries but they do not compete with the chinooks as they select smaller gravel and water of a lower velocity.

The young fish emerge from the gravel in late February, March and April and rapidly move out into the salt water. They are less dependent on the fresh water environment than are even the chinooks. Because of their small size when returning to the marine environment, they are more vulnerable to predators than are the other salmonids, and less capable of resisting the other ecological factors. The fact that these ecological factors are considerable is indicated by the wide fluctuations in the catches during the period for which we have collected data (Table 1, Figures 5, 6).

Sources of Statistical Information

All of the statistical material in this report has been obtained from the published statistical reports of the Washington State Department of Fisheries. It was decided to utilize only the material derived from the gill net fishery in Grays Harbor and Willapa, despite the fact there is statistical material from other fishing methods - especially the troll fishery that is listed in the Grays Harbor statistics. Although the troll chinook landings listed under Grays Harbor are much larger than the gill net fishery, there is no method of determining what proportion of the troll fish are fish derived from the Grays Harbor watershed. It has been repeatedly established that a large if not major proportion of the troll chinook taken off Grays Harbor originate in California, Oregon, Idaho, British Columbia, and other parts of Washington. The same statement can be applied to the silver salmon troll catch.

Although many Grays Harbor fish no doubt contribute to the offshore catch harvested by Washington fishermen and by those of other states and the province of British Columbia, this report can only have validity by using the Grays Harbor gill net catches.

Trends in Chinook Salmon Catches

An examination of Figure 1 and Table 2, which give the gill net catches of chinook salmon in Grays Harbor from 1935 to 1964 indicates a large yearly variability in catches. The catch varies at random with no indication of any consistent cyclic pattern. In Figure 1, to reduce the fluctuations of the data, four-year averages are shown. These data indicate considerable fluctuation in gill net catches. There has been a trend toward an increase in catch since 1957. The 1964 catch was the highest since 1945; the 9,627 fish represent a catch substantially higher (about one-third) than the 6,966 fish averaged for the previous 29 years. The 1961-1964 average catch was 8,468 fish and was 32.6% greater than the 6,385 mean catch for the previous 24 years.

The Washington State Department of Fisheries has subdivided the gill net catch by district and by time. The closer analysis of this data, which was not available for inclusion in this report, indicates that the upward trend in chinook catches is not consistent for all districts in Grays Harbor. There are two major river systems represented in the Grays Harbor catch; the Humptulips River and the Chehalis system. The major tributaries of the Chehalis are the Wynooche and the Satsop. Upon the latter stream the Washington State Department of Fisheries has a hatchery (Simpson hatchery), which rears chinook and silver salmon.

The catch of the Chehalis River system is divided statistically (as well as biologically) into an early and late run. These subdivisions of the catch data indicate that within the past four year period, 1961 to 1964, the Humptulips River and the early Chehalis runs have been increasing while the late Chehalis run has decreased in abundance. This data has not been completely compiled, so these conclusions are still tentative.

The Humptulips discharges into Grays Harbor estuary near its mouth and the fish in this run are not subject to the ecological changes resulting from the Aberdeen, Hoquiam, Cosmopolis municipal complex. The Chehalis river discharges between these cities. The gill net fishery operating on the Chehalis river fish is located near these cities. Although there probably is some intermingling of the various chinook populations, each fishery operates largely on the runs going either into the Humptulips or into the Chehalis.

The Humptulips catch is believed to be holding its own and, in fact, in the past years it has increased. The Washington State Department of Fisheries considers this chinook population to be in good condition. This agency is seriously concerned with the condition of the late chinook run to the Chehalis system. They are under the impression that the adults of both runs successfully migrate into the river before spawning. They do feel that the downstream migrants of the late spawning run do not readily migrate through the Chehalis estuary but are delayed for a period of time that may last as long as a month and are subject to some mortality. This hypothesis is based primarily on the decline in the late Chehalis runs.

The progeny of the early Chehalis runs reach migratory size and move into the estuary in the late spring and early summer. The progeny of the late fall run are believed to migrate in the early summer and are believed to have the habit of residing in the estuary for a period during the summer where they are exposed to the water quality changes produced by the effluents, domestic and industrial, of the Tri-City complex.

Grays Harbor - Washington State

A comparison of the Grays Harbor catches with those of the entire state of Washington (Figure 1, Table 1) indicates some trends of interest. The catch for the state were relative stable until 1956 when a decline to a lower level of stability was observed. This decline in the state catch is due in large part to the declines in the Columbia River catches. At about the same time in 1957, the Grays Harbor catch started on its upward trend. Whatever else may be derived from this table, it is obvious that overall ecological conditions that obtain in the state of Washington do not override the efforts of water use policies in the larger streams which are the typical chinook streams. This situation does not seem to be true of the chum and silvers discussed in this report.

Grays Harbor - Willapa Harbor

Figure 2 (Tables 2, 3) represents a comparison of the gill net catches in the Grays Harbor area with those of Willapa Bay. Although Willapa Bay is the only other major estuary on the Pacific Coast of the state of Washington, and is immediately to the south of Grays Harbor, it differs in several major respects from Grays Harbor. First, it is relatively undeveloped by man, there is not the large human populations on Willapa Bay that there is on Grays Harbor, there are only minor industrial developments and none of these are major water users as are those industries of Grays Harbor. Although there are many streams that drain into Willapa, they are all small streams that drain rather small areas and do not compare in size with the major streams that drain into Grays Harbor. These two factors, small population and industrial development, and a markedly different hydrological regimen plus the two small salmon hatcheries on the Willapa drainage would lead one to assume that the catch statistics on the two areas would differ markedly.

But, as indicated by Figure 2, there is an extremely close correlation between the chinook salmon catches in the two areas. Not only are the catches in numbers of fish remarkably similar but there is an extremely close correlation in the catch trends. The extremely close correlation of the peaks and troughs warrant the conclusion that ~~the~~ some common ecological factor is more important in regulating the return to the fishery than are man's activities on either of the watersheds. Whether this ecological factor bears on the early life history of the chinook or whether it bears on its oceanic life cannot be determined with the data on hand.

Chinook Eggs Taken and Plants

The yearling and fingerling plants data from the Simpson hatchery are not of great value because the fish are planted not only in the Chehalis watershed but some are listed as being planted in Puget Sound streams such as the

Figure 1. Chinook salmon catches in Grays Harbor and entire state of Washington 1935-1965

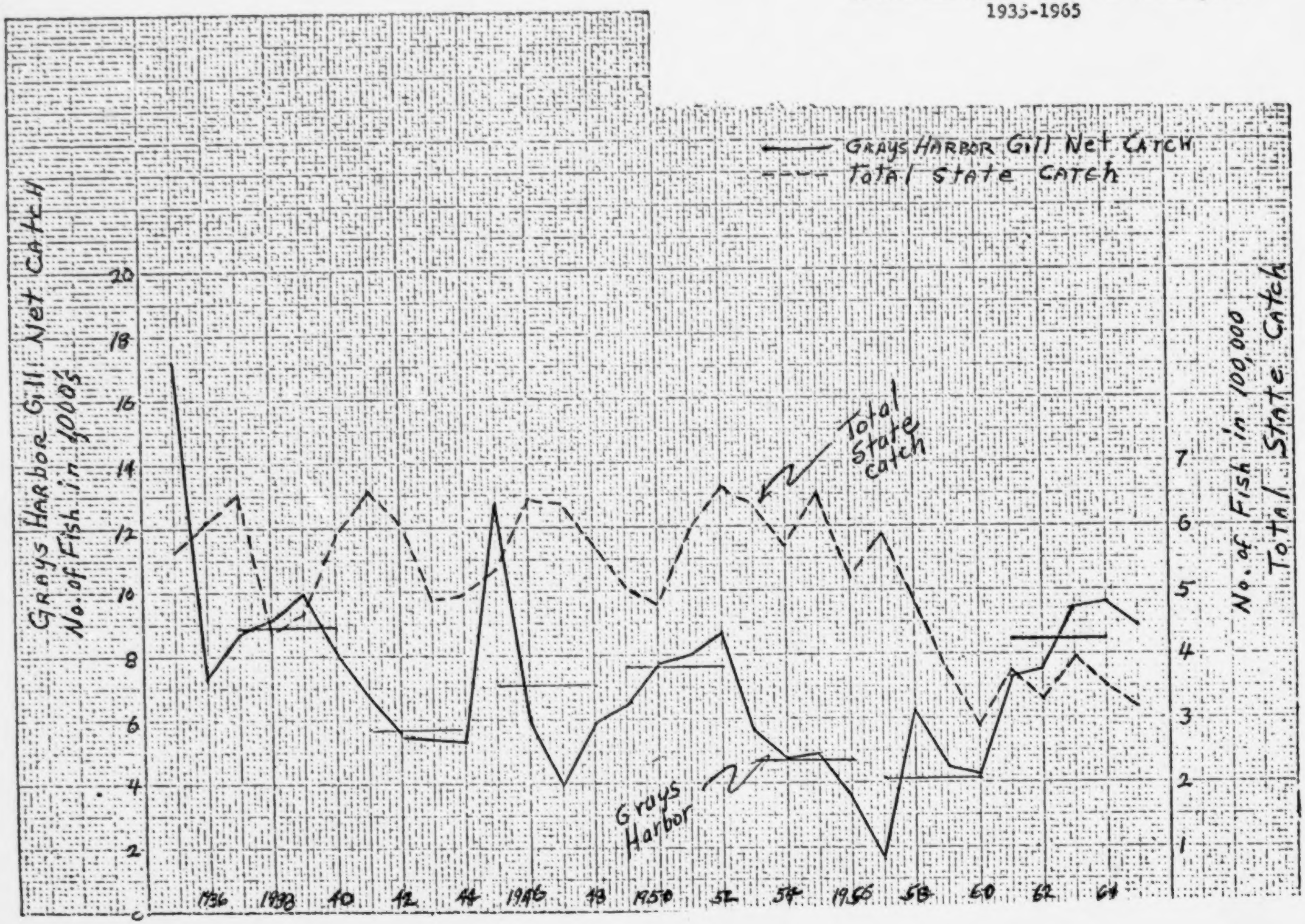


Figure 2. Chinook Salmon gill-net landings in Willapa and Grays Harbors, 1935-1965, including Indian catches. Data is from Washington State Dept. Fisheries Annual Reports.

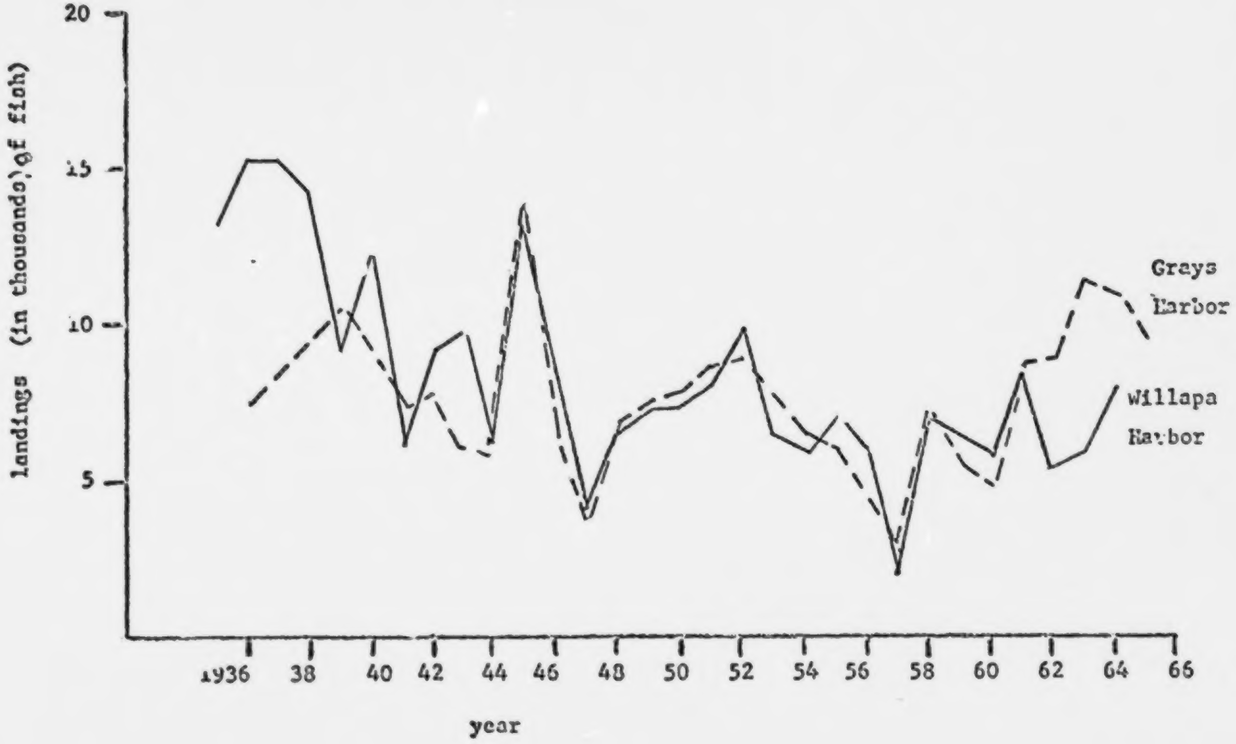


Table 2. Tabulation of gill net and Indian chinook salmon catches in Grays Harbor and returns to Simpson Hatchery, 1935-1965.

Year	Grays Harbor gill net catch	Chehalis River Indian catch	Total gill net & Indian catch	Escapement to Simpson Hatchery
1935	17,157	967	18,124	
1936	7,395	147	7,542	
1937	8,661	-	8,661*	
1938	9,042	243	9,285	
1939	9,878	597	10,475	
1940	8,052	557	8,609	
1941	6,741	644	7,385	
1942	5,545	2,268	7,813	
1943	5,438	743	6,181	
1944	5,288	595	5,883	
1945	12,688	1,052	13,740	
1946	5,939	525	6,464	
1947	3,982	371	4,353	
1948	5,852	5,059	10,911	
1949	6,430	876	7,306	
1950	7,665	113	7,778	
1951	7,987	338	8,325	
1952	8,744	204	8,948	70
1953	5,589	2,220	7,809	65
1954	4,762	1,884	6,646	209
1955	4,881	1,117	5,998	134
1956	3,595	1,310	4,905	103
1957	1,572	1,109	2,681	25
1958	6,197	1,177	7,374	-
1959	4,486	955	5,481	-
1960	4,217	813	5,030	77
1961	7,339	1,099	8,438	-
1962	7,531	1,444	8,975	-
1963	9,373	1,883	11,256	10
1964	9,627	1,293	10,920	16
1965	8,900	779	9,679	-
Mean	7,115	1,081	8,196	79

* gill net catch only

- indicates no data available

Data compiled from Washington State Department of Fisheries Annual Reports

Table 3. Landings of Salmon by Gill Net in Willapa Harbor

Year	Chinook	Silver	Chum
1935	13,142	21,309	35,597
1936	15,258	20,628	53,830
1937	15,205	12,319	51,309
1938	14,318	15,325	51,917
1939	9,068	13,799	29,208
1940	12,182	15,646	50,870
1941	6,028	8,107	136,346
1942	9,033	9,851	203,014
1943	9,985	9,070	85,289
1944	6,350	24,758	44,326
1945	13,291	33,224	43,635
1946	8,384	21,890	98,577
1947	4,586	26,084	54,031
1948	6,823	28,419	78,369
1949	7,678	31,044	41,086
1950	7,459	40,973	104,871
1951	8,045	48,425	106,949
1952	10,050	68,576	80,559
1953	6,568	24,475	105,808
1954	6,065	15,053	135,602
1955	7,032	30,304	83,159
1956	6,007	33,160	59,302
1957	2,174	6,156	61,768
1958	7,038	10,646	65,591
1959	6,622	6,846	67,101
1960	5,901	9,577	43,865
1961	8,218	11,646	24,365
1962	5,557	5,289	35,894
1963	5,909	1,754	12,070
1964	7,769	10,658	21,939

Deschutes River (near Olympia), the Skokomish River and Goldsborough Creek near Shelton, in 1964. Until the detailed breakdown of these plants are analyzed, it is difficult to determine the contribution of the hatchery to the Chehalis river adult fish. In fact, the state Department of Fisheries have regarded the Simpson hatchery as one of their chinook problem hatcheries. For some reason, the Chehalis river chinooks that have returned to the hatchery have been very difficult to handle successfully and have been a failure as a hatchery fish. In fact, in order to secure chinook eggs to operate the hatchery, the State Department of Fisheries has had to "import" eggs from the Deschutes River run (near Olympia).

A program which has the promise of success is the fertilization of eggs from Deschutes River fish (near Olympia) with male Chehalis fish. This "hybrid" seems to promise a fish that will be amenable to hatchery practice and will contribute to the salmon resources of the state.

Silver Salmon

~~Table 3 and~~ Figure 3 present the Grays Harbor gill net catches of silver salmon for the period 1935-1964. Irregular fluctuations in catch are apparent and seem to be characteristic. These annual fluctuations are the result of some catches being six times those of other years.

Table 3 presents Willapa landings only

The three year average smooths the graph substantially and permits an inspection of overall trends. From the 1950-52 period (63,515 fish mean annual catch), silver salmon catches dropped steadily to the 1962-64 period (22,848 fish mean annual catch). Unfortunately, a partitioning of the silver salmon catch by area and time has not been attempted. Therefore, it is not possible to assign this decline to a particular subgroup of the total Grays Harbor population.

The escapement to the hatchery indicates a somewhat rosier picture (Table 4). Since 1961, with the exception of 1963, the return to the hatchery has been over 4,000 fish. The 1965 return was over 8,000 fish. Although the Simpson hatchery will, of necessity, give first priority to the more valuable chinook, the surplus devoted to the silvers will contribute to the Grays Harbor silver catch.

Comparison of the Grays Harbor catch statistics with the catch of the entire state

There is a striking positive correlation between the catch trends in the state and those of the Grays Harbor system (Figure 3). This indicates that ecological conditions that contribute to the Grays Harbor catch obtain throughout the state. From some earlier studies we know that natural silver salmon production in all areas is positively correlated with summer stream flows. The coho fingerling spends one year in its natal stream before migrating to the ocean. A cool, wet summer during which stream levels are high will support many more juvenile salmon than will the same stream during a warm, dry summer in which the stream level is reduced. Obviously ecological conditions that obtain statewide have more importance in regulating silver production in Grays Harbor than does any ecological condition peculiar to Grays Harbor.

A comparison of silver salmon gill net landings in Willapa and Grays Harbors, 1935-1965 (Figure 4)

There is a good correlation between catches in the two harbor areas. In most cases, peaks in catch coincide and depressions coincide. There are some notable exceptions - 1939, 1947 and perhaps 1961 - in which there are peaks in the Grays Harbor catch which are not duplicated by the Willapa Harbor catch. Whether these are due to ecological disturbances within one watershed which did not occur in the other or whether it was due to some regulation restricting the Willapa catch cannot be determined from the statistical data available.

Chum Salmon

The gill net catch of chum salmon in Grays Harbor has fluctuated wildly in the 1935-64 period (Figure 5, Table 5). The greatest catch (1954) was 145,120 fish while the smallest (1965) was 4,541 fish, the magnitude of

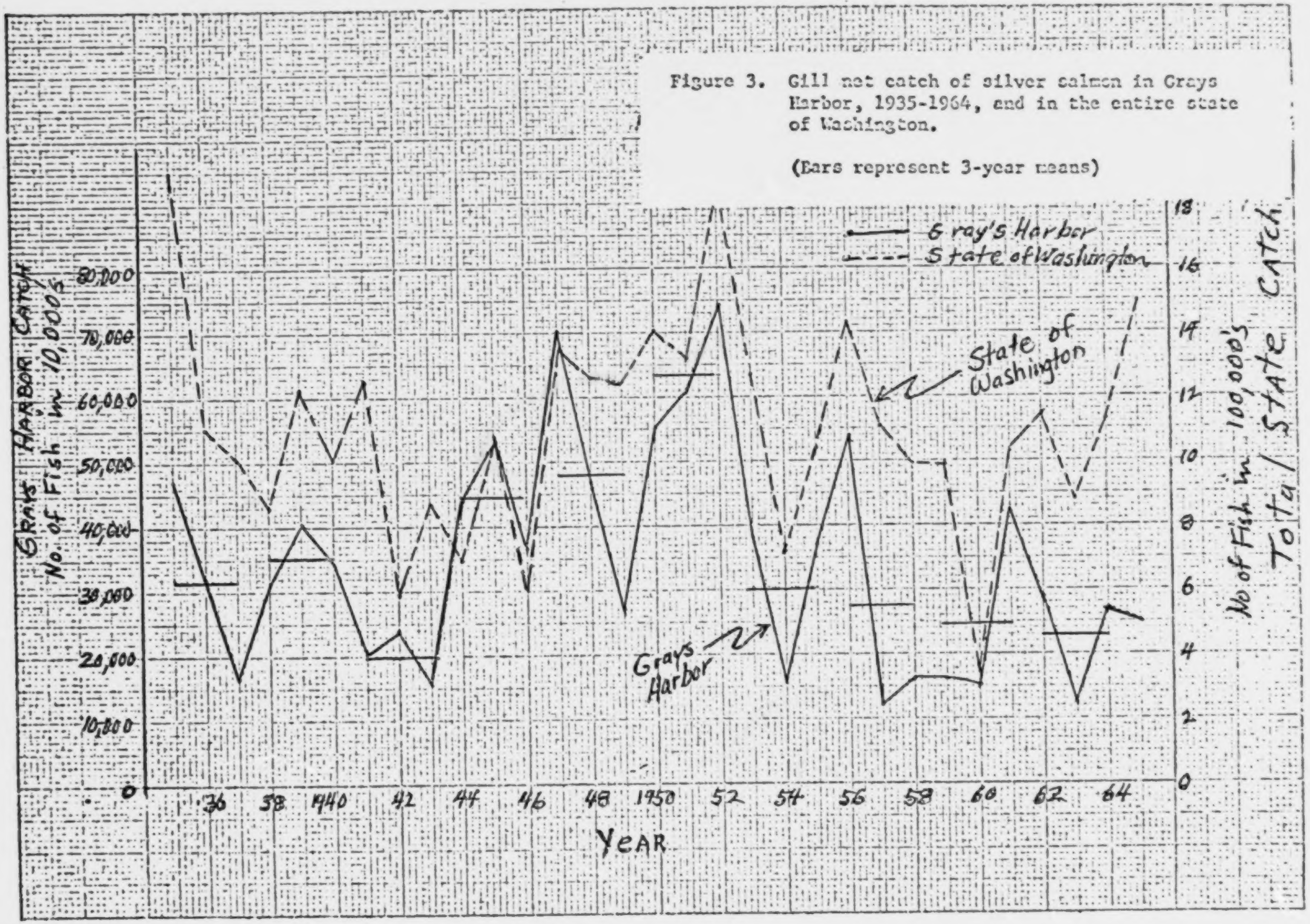
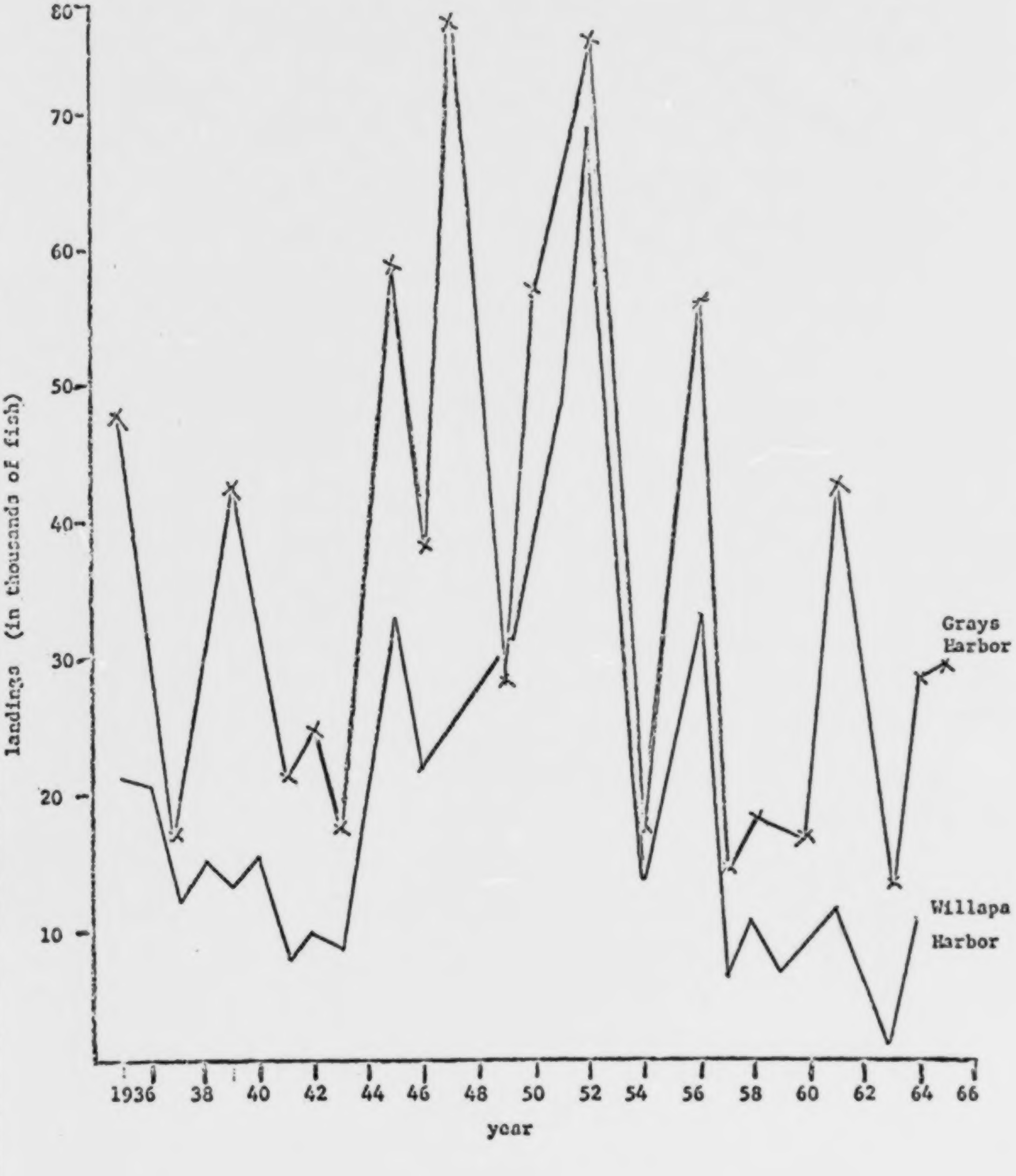


Figure 3. Gill net catch of silver salmon in Grays Harbor, 1935-1964, and in the entire state of Washington.

(Bars represent 3-year means)

Figure 4. Silver Salmon gill-net landings in Willapa and Grays Harbors, 1935-1965, including Indian catches. Data is from Washington State Dept. Fisheries Annual Reports.



variation is over 30 times.

The four-year means also vary substantially, the largest mean (1953-56) is about 5 times the smallest (1961-64). The recent trend of substantial decreases in catch from 1960-64 had a precedent during the 1943-49 period when only one year showed a catch above 27,000 fish. Again, since no breakdown of the chum catch by area has been attempted, there is no way to determine if the decline is general to the entire area or specific to one portion of the Grays Harbor population.

Comparison of the Grays Harbor catch statistics with that of the entire state of Washington

There is a very good correlation between the trends in chum salmon catches for the entire state of Washington and for the Grays Harbor area (Figure 5). It is obvious that there has been a decline in catch in Grays Harbor since 1954. The statewide decline started about 1950 and has continued in an almost uninterrupted trend since that time. Of particular interest is the good correlation of peaks of abundance and depressions of scarcity in both the statewide catches and the Grays Harbor catches. This correlation suggests that some common ecological factor that obtains throughout the entire chum producing areas in the state are responsible for the changes in the chum populations. The close correlation in the two curves suggests that these ecological changes are correlated with some biological or meteorlogical factor in the environment and that man's effect on this species is perhaps secondary.

The readers are cautioned to note the scale. The scale of the statewide catches is 10 times that of Grays Harbor. It must also be noted that the chum salmon is not typically raised in hatcheries so that no correlation of. fish cultural activities with catches is possible.

Table 5. Tabulation of gill net and Indian chum salmon catches in Grays Harbor and returns to Simpson Hatchery, 1935-1965.

Year	Grays Harbor gill net catch	Chehalis River Indian catch	Total commercial and Indian catch	Escapement to Simpson Hatchery
1935	20,470	354	20,824	
1936	39,087	83	39,170	
1937	39,920	685	40,605	
1938	36,356	3,395	39,751	
1939	15,191	3,314	18,505	
1940	23,862	6,496	30,358	
1941	124,428	9,273	133,701	
1942	85,574	6,150	91,724	
1943	21,299	4,784	26,083	
1944	15,450	54	15,504	
1945	24,424	1,358	25,782	
1946	71,425	8,192	79,617	
1947	22,040	3,730	25,770	
1948	26,919	3,512	30,431	
1949	17,608	943	18,551	
1950	41,488	3,653	45,141	192
1951	60,171	4,791	64,962	1,028
1952	46,761	3,952	50,713	85
1953	35,762	2,668	38,430	124
1954	145,120	8,015	153,135	1,017
1955	60,421	2,219	62,640	119
1956	26,074	1,370	27,444	34
1957	37,235	1,245	38,480	1,050
1958	60,938	1,368	62,306	1,166
1959	73,478	2,981	76,459	2,379
1960	19,728	1,090	20,818	1,064
1961	11,086	2,768	13,854	107
1962	21,070	1,273	22,343	1,374
1963	7,079	473	7,552	1,124
1964	13,601	40	13,641	282
1965	4,541	692	5,233	-
Mean	40,278	2,933	43,211	743

indicates no data available

Data compiled from Washington State
Department of Fisheries Annual Reports

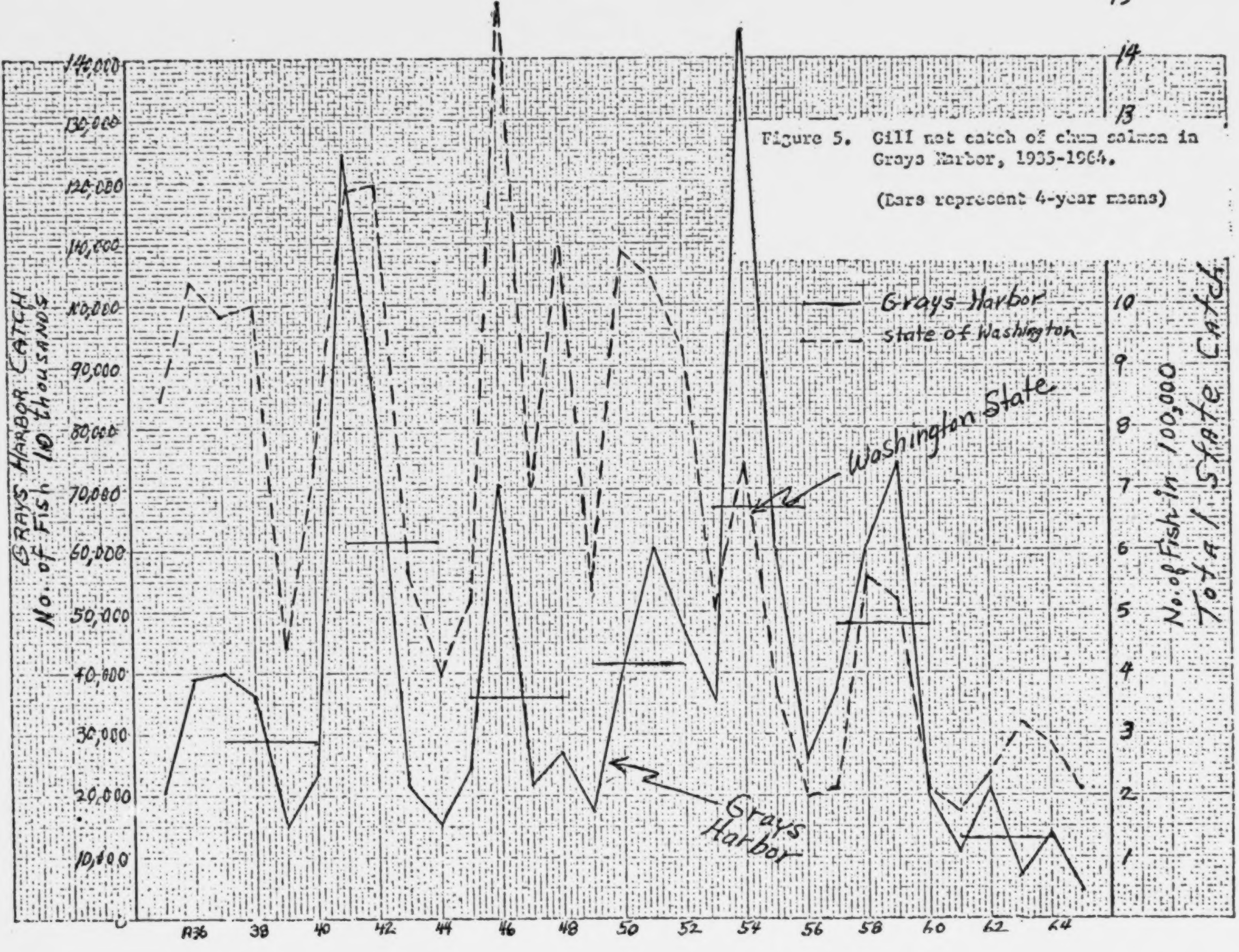
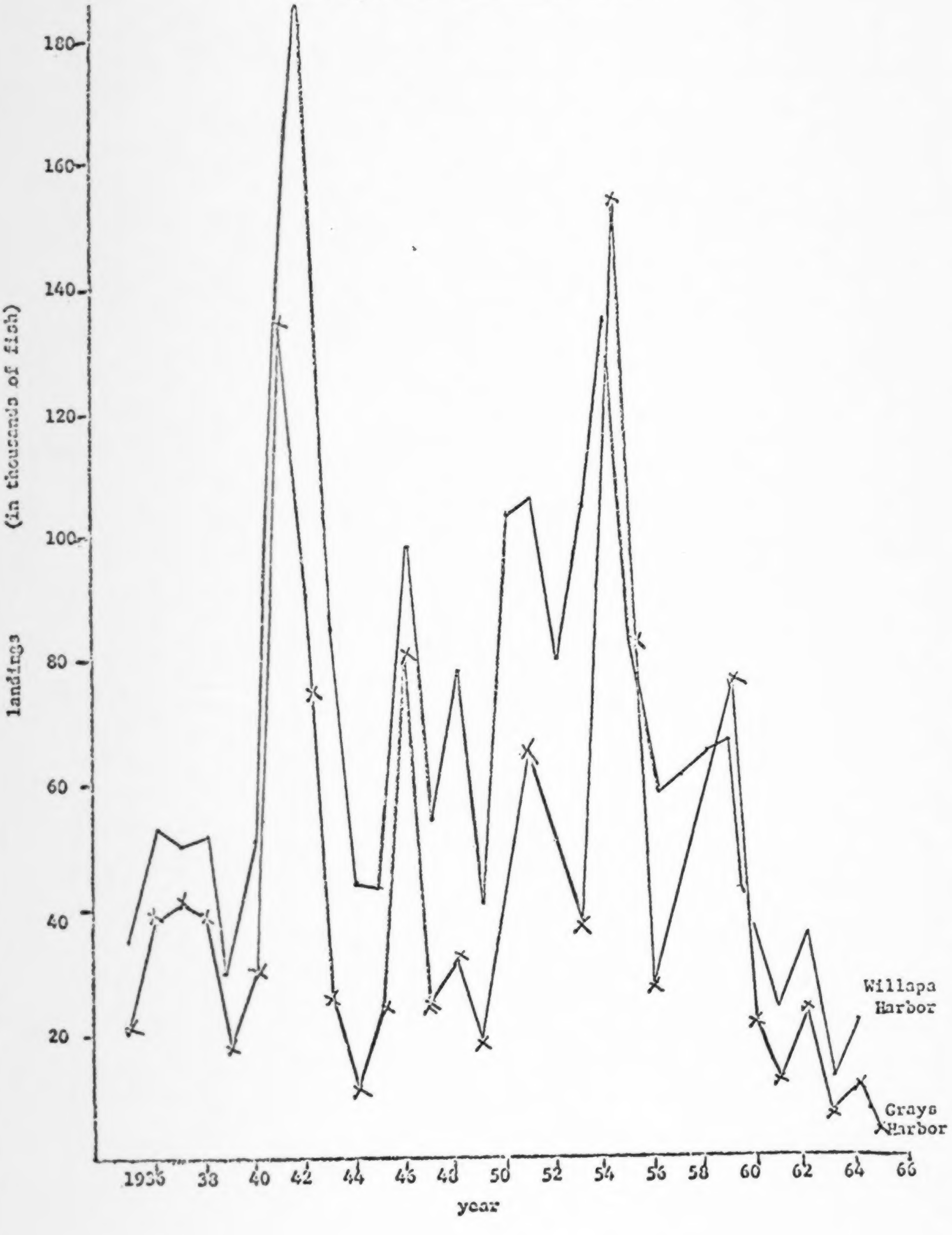


Figure 5. Gill net catch of chum salmon in Grays Harbor, 1935-1964.

(Bars represent 4-year means)

Figure 6. Chum salmon gill-net landings in Willapa and Grays Harbors, 1935-1965, including Indian Catches. Data is from Washington State Dept. Fisheries Annual Reports.



A comparison of chum salmon gill net catches in Willapa and Grays Harbor, 1935-1965

Figure 6 indicates the marked decline of chum catches in Willapa and Grays Harbor since about 1959 which is observed throughout the state. In common with the other catch comparisons for chinook and silvers, there is an excellent correlation between the catches of chums in both harbor areas. It is concluded that common ecological factors obtain in both watersheds that are more important in regulating the chum salmon populations that are man's activities.

TRENDS IN THE STEELHEAD SPORT FISHERY IN THE STATE OF WASHINGTON WITH EMPHASIS ON THE FISHERY IN STREAMS OF THE PUGET SOUND, HOOD CANAL, AND GRAYS HARBOR AREAS.

BY

MAX KATZ AND WAYNE HEINZ

BIOLOGICAL CONSULTANTS

A STUDY SPONSORED BY NORTHWEST PULP & PAPER ASSOCIATION

Trends in the steelhead sport fishery in the State of Washington with emphasis on the fishery in streams of the Puget Sound, Hood Canal, and Grays Harbor areas.

by

Max Katz and Wayne Heinz
Biological Consultants

The sport fishery for the steelhead trout, Salmo gairdneri, especially for the winter steelhead, is claimed to be the most important freshwater sport fishery in the State of Washington. In the year 1964, the last year for which data is available, 171,400 steelhead punch cards were issued and 176,180 fish were estimated to have been taken. According to a recent survey made for the Game Department, 1,436,000 angler days were spent by steelhead fishermen. The top catch was listed for 1963 when 237,350 fish were taken. If we assume that each steelhead averages 5 lbs in weight, this indicates a production of about 1,185,000 lbs of fish. Rainbow trout in the retail market are sold for $.70/lb and the retail value of these fish as food would be $829,500. A much better estimate of the value of the steelhead fishery might be suggested if one proposes that a usual trip to a steelhead involves a round trip drive of 50 miles. Assuming that each steelhead fisherman makes two trips a year, and that it costs 5¢ a mile to drive his car, this fisheries generates (as a very conservative estimate) an expenditure of $855,000 a year for automobile transportation alone. We have no data upon which to evaluate other expenditures but from personal observation we know that most steelhead fishermen have a pair of hip boots or waders costing conservatively $10., rain gear $10., a rod costing $10., a reel valued at $15., line and terminal gear valued at $1.50. These figures indicate that the steelhead fishermen have made capital investments of at least $7,951,500. These figures do not include the specialized boats and trailers used by some enthusiasts, and the guide boat industries of the Skagit Rivers and the Olympic Peninsula streams. A conservative estimate suggests that the steelhead fishery of Washington State generates an expenditure of $5,000,000/year - a formidable figure by any criterion.

The Washington State Department of Game is the state agency which has the assignment of regulating and managing this fishery and it has devoted a large portion of its staff and financial resources to this fishery with a great deal of success. As indicated by Table 1, the winter steelhead catch has increased almost ten-fold from 22,000 fish in 1947 to 237,000 fish in 1963. The number of steelhead fishermen has increased four-fold - from 41,000 in 1948 to 171,000 in 1964. This great increase in steelhead catch has been accomplished largely by increasing the numbers of downstream migrant steelhead planted in the rivers of Washington by the Washington Department of Game.

It is obvious that the natural reproduction of steelhead could not support a fishery of the present intensity. Most steelhead in nature spend two years after hatching in the headwaters of our rivers before they migrate to the ocean feeding grounds. Under even the best water-use conditions, two dry summers in a row could mean that only a few fish could find enough food to survive and grow to migratory size. Two wet, cool summers in succession are required for a favorable return of fish derived by natural production. It was obvious to the Washington Department of Game that great numbers of steelhead would have to be reared in hatcheries in order to provide enough fish to support a fishery that would yield a satisfactory return to the anglers. In the early years, the practice was to rear large numbers of eggs and fry to the stage at which they could feed independently and then release the small fish into the streams, but it soon was obvious that these fish could not compete with the offspring of the naturally spawned fish which had already occupied all of the desirable ecological niches. The fry plant program did not result in a substantial return to the fisherman. The biologists of the Game Department developed a technique of intensive feeding of steelhead in selected hatcheries with a warm water supply, and were able to raise fish to the migratory size of 7" to 9" within a year. These fish were planted in the late spring at the same time in which the naturally reared fish migrate to the ocean. The improved catches indicated that this was a useful procedure and the rearing and planting program of the Game Department was rapidly switched from a fry planting program to a downstream migrant planting program (Tables 2, 6). At first glance it might seem that the State Department of Game has cut back on its hatchery program: Table 6 indicates that over 5,600,000 fish were planted in 1939 while only 830,000 fish were planted in 1965. But this actually indicates a major increase in effort and expenditures for the early program was a program in which large numbers of fish were held for only a few weeks in the hatchery and then planted, while the 1965 data indicates an expensive program in which a smaller number of fish were held for a year. The latter program involves a heavy expenditure of funds to provide for permanent hatchery facilities, manpower, fish food, water supplies, disease control and supervision.

A new development which offers an increased production of migrants at a minimum cost is the pond rearing program which has been so successful on the Skagit and Stillaguamish rivers. This has resulted in the steelhead bonanza that is attracting thousands of anglers to the Skagit and Stillaguamish rivers. Another program that has proven successful is the summer steelhead program on the Stillaguamish river.

The State Department of Game's imaginative and productive program has been very successful and its program has been adopted by the State of Oregon with equal success. Although the Game Department's steelhead program has been an unqualified success, and is already recognized professionally as a classic of fisheries management, they cannot afford to rest on their laurels. As pointed out previously in Table 1, not only has the catch increased greatly but so have the numbers of fishermen. The Department is faced with the horrendous task of keeping up with the population explosion in our state and it must provide the same excellent fishing for an ever-increasing number of fishermen. The population boom in the Puget Sound area not only provides more anglers but increases the demands upon the water supplies for domestic use, industrial use, agricultural use, and the other uses of water. An example of this competition for water which has directly affected steelhead is the loss of part of the Tolt River watershed to the City of Seattle, for domestic water supply. Plans by the City of Seattle are already on hand for the remaining portion of the Tolt River watershed. It is desirable, therefore, to critically examine the steelhead program of the State Department of Game to see if there are any trends which indicate factors that may limit steelhead production and catches in the State of Washington. Particular attention is paid to the streams of the Puget Sound region in which the bulk of the state's population and their productive activities are centered, and the Grays Harbor area. (Fig. 3, 4) These are the areas in which the greatest amount of fishing takes place, and the greatest industrial development has taken place.

The data used is from the unpublished data of the Washington State Department of Game. Although much of this data has been published in Bulletins and Publications of the Game Department (2, 3, 4, 5, 7, 8, 12, 16) in scientific journals (6,), and in unpublished Game Department Bulletins (9, 10, 11, 13, 14, 15) and by others (17,), it was felt desirable to go to the original sources to minimize error, i.e., the files of the Washington State Department of Game. Data from the winter of 1947 through the last complete year of 1964 were utilized for this study. Steelhead plant data (Table 4) were available from 1939 on.

As indicated in Table 1, and Figure 2, the steelhead catch has shown a consistent and sometimes rapid upward trend in Puget Sound. Until about 1951 the correlation of the catch with the plants was poor. This is explained by the fact that prior to 1950 the majority of the plants were of fry which had a very low survival potential. After 1950 plants of migratory sized fish were increasingly predominant and the catches reflected the success of this planting policy. It is difficult to explain some of the downward deviations from the trend between 1956-1959, but it should be remembered that the rivers during the winter are not always fishable. Steelhead locate the lures of the fishermen by sight and conditions which render the rivers high and muddy decrease and sharply limit the availability of the fish to fishermen.

A series of rain storms or floods which cause the rivers to be muddy over the weekends in which the bulk of the fishing trips take place will sharply decrease the catch. Most of the hatchery fish which are planted as migrants are of Matthews Creek stock, a strain which returns to the streams primarily in December. Heavy rains during December, of which this December (1966) is a prime example, will make a large percent of these hatchery fish unavailable to the anglers, with a consequent poor return indicated. It is entirely possible that a record number of returning fish will not be reflected by the catch. The Game Department does not have the facilities to count returning fish of the hatchery weirs as can the Department of Fisheries with its salmon, and the only indication of the magnitude of a return is by the angler reports, i.e., punchcards.

In Figure 2, the data comparing the steelhead catch in Puget Sound with those of the rivers of the rest of the state is diagrammed. There is a very close correlation between these groups of data indicating a spectacular rise in steelhead catch in both major areas. It is obvious that water uses which enhance or limit the production in Puget Sound must obtain in other parts of the state. The leveling off in catch in Puget Sound between 1956 and 1959 is matched by an equally sharp decline in the rest of the state in 1962 and 1964. The increases since 1961 in Puget Sound is matched by increases of the same magnitude in the rest of the state.

Figure 4 which diagrams the steelhead catch data of the State of Washington, the Puget Sound drainage, and the Grays Harbor drainage, is of interest because of the relatively slow increase of the Grays Harbor steelhead catches as compared to the entire state and of Puget Sound. Although there is an increase in the Grays Harbor catch, it does not match the spectacular catches of the Puget Sound area. This can be explained by reference to Table 2 which lists the plants made in the Grays Harbor rivers, the Humptulips, the Chehalis, the Wynoochee, and the Satsop. These Game Department data indicate that only the Humptulips is planted consistently while the other rivers are only planted on an irregular basis. The plants in these rivers vary between 191,000 fish in 1953 to 70,400 in 1959, with a mean plant of 87,700 fish. This can be contrasted to the average plants of the Skagit of 135,200 and the Snohomish River system of 188,900. These data suggest that the factor limiting the Grays Harbor catch is the number of fish planted. This is not to be regarded as a criticism of the Game Department's planting policies, but a recognition of the fact they are wisely making their heaviest plants in the river systems adjacent to the major population centers.

The analysis of all of the other information which is collected in the appendix of this report confirm (1) the trend to an increase in the catch (2) this increase can be correlated with the migratory planting program of the Washington State Department of Game. Although these data have not been subjected to rigorous statistical analyses, the same trends positively correlating plants and angler catch are observed in those streams in which the greatest urban and rural development obtains. Of particular interest is the data in Figure 5 and Table 9 which shows the winter steelhead sport catch in the Snohomish River system which drains into Everett Harbor. The Skykomish catch increased from 270 fish in 1947 and 1,230 fish in 1948 to catches varying between 8,000 and 10,000 fish from 1961 to 1964. The Snohomish increased from 300 fish in 1947, 380 in 1948, to between 6,000 and 9,000 fish in 1961 and 1964. Increases of the same magnitude are observed in Table 9 in the Pilchuck and Snoqualmie, and other important tributaries.

Although these fish may be subjected to a wide variety of ecological disturbances in the Everett Harbor area, their increase in catch in the Snohomish greatly exceeds that exhibited by rivers which empty into estuaries with little or no industrial development, e.g., the Dosewallips and the Quilcene Rivers of the Hood Canal and, Figure 2 and Table 11.

Summary and Conclusion

All of these data, obtained from the files of the Washington State Department of Game and their publications, conclusively demonstrates that the catch of winter steelhead has greatly increased since 1947 and the trend in catch is going upward. This increase in catch can be credited to the Washington State Department policy of planting migrant-sized steelhead fingerlings.

There is not yet any data which suggests that there is any ecological factor which is limiting the winter steelhead catch. If the state is able to find additional hatchery sites and, of course, obtain the funds necessary to rear the increased number of fish, it seems reasonable that it can maintain excellent steelhead fishing for the anglers of the State of Washington. If there are indeed changes in stream ecology and water quality that are having undesirable effects on the steelhead populations, it is obvious that they are of minor magnitude and are being compensated for easily by the steelhead management program of the Washington State Department of Game. Although there is no cause for complacency (as indicated by the loss of part of the Tolt watershed to the City of Seattle) (the Green River and the Cowlitz River to the City of Tacoma) it seems reasonable that the active and progressive Washington State Department of Game will continue to supply excellent sport fishing in the future provided, of course, it is adequately supported by the sportsmen and the public of the State of Washington.

Table 1. Punchcards issued and winter run steelhead sport catch in Washington State, estimated from punchcard returns, 1947-1964

Number of fish by area

Winter Beginning	Washington State	Puget Sound	Washington State minus Puget Sound	Punchcards	Success ratio Washington State
1947	22,740	10,720	12,020	-	-
1948	40,900	19,850	21,050	41,000	1.00
1949	56,660	26,050	30,610	50,000	1.13
1950	60,340	21,830	38,510	50,000	1.21
1951	118,290	58,220	60,070	62,500	1.90
1952	123,330	66,940	56,390	77,300	1.60
1953	162,500	85,650	76,850	89,300	1.82
1954	130,980	67,750	63,230	71,200	1.84
1955	161,620	95,030	66,590	88,700	1.82
1956	120,600	63,570	57,030	85,300	1.41
1957	139,320	53,970	85,350	85,400	1.63
1958	126,530	60,540	65,990	84,400	1.50
1959	148,280	67,960	80,320	87,900	1.69
1960	117,400	56,940	60,460	93,300	1.26
1961	193,300	92,410	100,890	145,000	1.33
1962	198,300	75,580	122,720	151,700	1.31
1963	237,350	132,270	105,080	160,400	1.50
1964	176,180	90,860	85,320	171,400	1.03
1947-1964	2,334,620	1,146,140	1,188,480	1,594,800	24.98
mean	129,700	63,670	66,030	93,811	1.46

$$\text{Success ratio} = \frac{\text{Catch}}{\text{Punchcards}}$$

Figures to nearest ten fish or nearest 100 punchcards

Based on unpublished data from Washington State Game Department,
Olympia, Washington

Table 2. Winter run steelhead plants in
Grays Harbor Drainage, 1947-1964

Numbers of fish, by rivers

Year	Humptulips	Chehalis	Wynoochee	Satsop	Grays Harbor Drainage Total
1945	76,400	34,500	-	6,300	117,200
1946	-	37,300	-	26,800	64,100
1947	-	-	-	20,000	20,000
1948	-	30,800	10,600	-	41,400
1949	22,000	5,300	25,300	18,400	71,000
1950	-	6,000	18,600	31,500	56,100
1951	30,000	-	15,000	32,700	77,700
1952	-	-	-	55,600	55,600
1953	26,500	45,500	-	119,000	191,000
1954	47,900	8,200	48,200	50,600	154,900
1955	77,600	13,100	-	-	90,700
1956	82,900	-	-	-	82,900
1957	73,100	17,500	-	-	90,600
1958	73,600	-	-	3,000	76,600
1959	49,500	-	-	20,900	70,400
1960	60,600	-	-	29,700	90,300
1961	71,600	-	-	20,000	91,600
1962	80,000	-	20,600	-	100,600
1963	80,000	-	-	25,000	105,000
1964	74,000	-	-	19,000	93,000
1965	72,000	22,000	-	-	94,000
1966	80,000	-	-	15,000	95,000
1945-1966	1,077,700	220,200	138,300	493,500	1,929,700
Mean	63,400			30,800	87,700

- denotes data unavailable

Figures to nearest 100 fish

Based on unpublished data from Washington State Game Department,
Olympia, Washington

Table 3. Winter run steelhead sport catch in Grays Harbor Drainage, 1947-1964, estimated from punchcard returns.

Numbers of fish, by rivers*

Winter Beginning	Humptulips	Chehalis	Wynoochee	Satsop	Grays Harbor Drainage Total
1947	680	3,240	340	100	4,360
1948	760	2,700	760	420	4,640
1949	620	5,950	540	600	7,710
1950	770	4,340	850	670	6,630
1951	2,020	8,070	1,720	770	12,580
1952	2,260	5,460	1,800	1,300	10,820
1953	3,860	6,940	2,630	2,750	16,180
1954	4,500	5,040	1,930	1,990	13,460
1955	6,800	6,990	1,460	1,410	16,660
1956	6,500	4,570	1,250	1,360	13,680
1957	11,400	7,700	890	820	20,810
1958	8,510	4,060	860	1,560	14,990
1959	6,230	4,310	800	880	12,220
1960	3,570	3,090	460	780	7,900
1961	10,830	6,520	1,330	1,810	20,490
1962	12,680	6,800	1,390	1,840	22,710
1963	9,410	7,590	2,370	1,510	20,880
1964	6,630	4,760	1,250	1,690	14,330
1947-1964	98,030	98,130	22,630	22,260	241,050
Mean	5,450	5,450	1,260	1,240	13,390

*Figures to nearest ten

Based on unpublished data from Washington State Game Department,
Olympia, Washington

Table 4. Winter run steelhead plants in Puget Sound Area, by major river systems, 1945-1966.

Number of fish, by river system*

Year	Lake Washington Area	Hood Canal Area	Puyallup Rivers	Skagit Rivers	Snohomish Rivers	Stillaguamish Rivers
1945	3,500	160,000	37,700	19,800	311,500	238,800
1946	-	200,000	65,900	46,300	250,000	63,900
1947	17,400	-	177,600	84,700	361,800	75,800
1948	45,900	-	53,500	61,500	209,700	95,600
1949	85,300	5,000	302,000	138,300	106,400	50,900
1950	60,000	19,800	284,000	99,800	137,400	14,400
1951	12,100	29,200	66,500	26,900	90,800	20,600
1952	19,200	13,900	174,700	198,100	96,200	10,000
1953	40,800	48,900	71,000	137,100	215,900	33,700
1954	29,400	166,000	48,300	180,000	140,200	47,800
1955	43,700	157,700	70,300	62,600	122,300	30,000
1956	42,600	79,900	72,000	71,500	198,200	35,400
1957	30,000	57,300	80,800	61,000	127,400	71,100
1958	61,800	28,600	56,000	67,000	112,800	103,000
1959	43,900	46,700	64,000	63,500	160,800	34,000
1960	43,500	50,400	79,700	670,800	132,100	2,500
1961	49,400	61,500	57,200	96,000	149,100	-
1962	57,700	85,200	65,800	137,000	187,600	-
1963	57,000	85,000	63,000	98,000	276,100	40,000
1964	56,000	89,000	94,000	211,000	241,000	-
1965	57,000	71,200	65,000	163,600	262,500	102,000
1966	53,000	57,100	100,000	279,000	265,300	-
1945-1966	909,200	1,512,400	2,149,000	2,973,500	4,155,100	1,069,500
Mean	43,290	75,600	97,700	135,200	188,900	59,400

*Figures to nearest 100 fish

See Table 5 for specific rivers

Based on unpublished data from Washington State Game Department,
Olympia, Washington

Table 5. Winter run steelhead sport catch in Puget Sound Area, by major river systems, 1947-1964, estimated from punchcard returns.

Number of fish, by river system*

Winter Beginning	Lake Wash. Area	Hood Canal Area	Puyallup Rivers	Skagit Rivers	Snohomish Rivers	Stillaguamish Rivers	Grand Total
1947	-	600	1,930	3,800	1,150	500	
1948	-	840	4,640	5,400	2,730	1,160	
1949	90	710	7,450	7,290	4,020	220	
1950	300	1,840	6,040	6,010	4,290	360	
1951	250	1,510	15,650	13,780	9,580	1,650	
1952	790	2,470	15,570	13,270	14,320	2,250	
1953	1,310	5,220	19,300	17,250	17,420	3,400	
1954	1,170	2,300	14,490	11,220	15,290	3,530	
1955	2,710	4,400	20,350	22,490	18,410	3,330	
1956	1,260	4,400	14,190	13,710	14,080	1,640	
1957	1,040	5,330	8,800	11,580	14,900	2,240	
1958	1,170	4,220	7,520	15,990	13,010	1,590	
1959	1,880	4,070	9,550	19,630	11,700	2,880	
1960	2,460	4,050	4,680	13,990	14,310	3,200	
1961	2,470	5,440	10,420	19,630	22,080	8,080	
1962	2,550	4,800	11,720	22,810	21,940	7,820	
1963	2,180	11,500	16,120	37,070	27,000	10,210	
1964	2,010	6,070	6,910	22,250	22,990	10,420	
1947-1964	23,640	69,770	195,330	277,170	249,220	64,480	879,610
Average	1,480	3,880	10,850	15,400	13,850	3,580	49,040

*Figures to nearest 10 fish

Lake Wash. Area = Lake Union Ship Canal, Sammamish.
Hood Canal Area = Dungeness, Quilcene, Dosewallips, Duckabush, Skokomish.
Puyallup = Puyallup, White, Stuck, Carbon.
Skagit = Skagit, Sauk.
Snohomish = Snohomish, Skykomish, Snoqualmie, Tolt, Pilchuck R.
Stillaguamish = Mainstream, North Fork, South Fork.

Based on unpublished data from Washington State Game Department,
Olympia, Washington

Table 6. Winter run steelhead sport catch in North Puget Sound Area, 1947-1964, estimated from punchcard returns.

Number of fish, by river*

Winter Beginning	Nooksack & Forks	Samish	Skagit	Sauk	Mainstem, Stillaguamish	North Fork, Stilly	South Fork, Stilly	N.Puget Sound Total
1947	1,290	40	3,700	100	500	-	-	5,630
1948	1,450	370	5,290	110	1,160	-	-	8,380
1949	1,100	250	7,170	120	220	-	-	8,860
1950	1,240	120	5,570	440	310	50	-	7,730
1951	3,500	2,100	13,370	410	1,220	410	20	21,030
1952	2,730	3,220	12,140	1,130	1,750	360	140	21,470
1953	3,650	1,800	16,170	1,080	2,020	1,150	230	26,100
1954	2,500	1,360	10,280	940	2,230	1,020	280	18,610
1955	2,840	1,530	21,790	700	1,920	1,090	320	30,190
1956	1,050	1,360	12,940	770	1,090	400	150	17,760
1957	1,490	2,270	10,760	820	1,200	1,030	10	17,580
1958	1,400	2,950	14,800	1,190	860	700	30	21,930
1959	1,060	1,890	18,570	1,060	1,360	1,180	340	25,460
1960	950	2,360	12,570	1,420	1,620	1,420	160	20,500
1961	2,090	3,490	18,540	1,090	2,770	4,970	340	33,290
1962	2,120	3,720	21,420	1,390	2,680	4,820	320	36,470
1963	2,250	3,540	34,900	2,170	2,990	6,790	430	53,070
1964	2,480	2,630	20,830	1,430	3,750	6,100	570	37,790
1947-1964	35,190	35,000	260,810	16,360	29,650	31,490	3,340	411,850
Average	1,960	1,940	14,490	910	1,650	2,100	240	22,880

* Figures to nearest ten fish

Based on unpublished data from Washington State Game Department,
Olympia, Washington

Table 7. Winter run steelhead sport catch in Everett-Seattle Area, 1947-1964, estimated from punch-card returns.

Number of fish, by river*

Winter Beginning	Pilchuck River	Snohomish	Skykomish	Snoqualmie	Tolt	Lake Union Ship Canal	Sammamish	Grand Total
1947	120	300	270	290	170	-	-	
1948	260	380	1,230	710	150	-	-	
1949	360	780	1,320	1,040	520	90	-	
1950	900	610	1,640	670	470	300	-	
1951	830	2,230	3,030	2,790	700	250	-	
1952	1,350	1,870	5,630	3,920	1,550	210	580	
1953	2,640	3,040	7,190	2,810	1,740	260	1,050	
1954	1,720	3,820	5,580	3,230	940	330	840	
1955	1,400	4,700	7,850	3,880	580	1,250	1,460	
1956	1,270	2,980	5,480	3,700	650	330	930	
1957	990	5,120	4,650	3,410	730	210	830	
1958	1,590	4,050	3,340	2,990	1,040	360	810	
1959	1,010	4,080	3,870	2,160	580	760	1,120	
1960	1,740	4,030	6,170	1,840	530	1,020	1,440	
1961	2,670	6,170	8,750	3,460	1,030	990	1,480	
1962	2,780	6,330	8,450	3,460	920	1,010	1,540	
1963	2,610	9,150	10,130	4,350	760	1,150	1,030	
1964	1,850	7,350	8,030	5,200	560	970	1,040	
1947-1964	26,090	66,990	92,610	49,910	13,620	9,490	14,150	272,860
Average	1,450	3,720	5,150	2,770	760	590	1,090	15,530

*Figures to nearest ten fish

Based on unpublished data from Washington State Department of Game,
Olympia, Washington

Table 8. Winter run steelhead sport catch in South Puget Sound Area, 1947-1964, estimated from punchcard returns.

Number of fish, by river*

Winter Beginning	Green	White (Stuck)	Puyallup	Carbon	Nisqually	South Puget Sound Total
1947	1,220	110	1,770	50	150	3,300
1948	1,890	470	3,920	250	1,370	7,900
1949	4,550	890	6,300	260	370	12,370
1950	2,840	800	4,810	430	430	9,310
1951	7,070	830	14,590	230	3,130	25,850
1952	9,170	650	14,190	730	3,150	27,890
1953	11,680	1,380	16,890	1,030	4,620	35,600
1954	11,290	720	13,350	420	4,600	30,380
1955	15,660	1,040	18,500	810	3,310	39,320
1956	8,840	790	12,780	620	3,000	26,030
1957	11,610	300	7,950	550	3,710	24,120
1958	10,080	270	6,870	380	2,610	20,210
1959	11,770	310	8,830	410	3,530	24,850
1960	8,450	300	4,140	240	2,490	15,620
1961	15,700	410	9,430	580	3,010	29,130
1962	14,660	410	10,890	420	2,720	29,100
1963	17,480	960	14,650	510	4,920	38,520
1964	13,160	300	6,310	300	1,940	22,010
1947-1964	177,120	10,940	176,170	8,220	49,060	421,510
Average	9,840	610	9,790	460	2,730	23,420

*Figures to nearest ten fish

Based on unpublished data from Washington State Game Department,
Olympia, Washington

Table 9. Winter run steelhead sport catch in Eastern Olympic Peninsula Area, 1947-1964, estimated from punchcard returns.

*Number of fish, by river

Winter Beginning	Dungeness	Quilcene	Dosewallips	Duckabush	Skokomish	Olympic Peninsula Area Total
1947	360	-	70	20	150	600
1948	370	-	120	70	280	840
1949	260	-	30	70	350	710
1950	740	-	90	150	860	1,840
1951	420	-	170	190	730	1,510
1952	740	140	330	500	760	2,470
1953	2,600	110	800	550	1,160	5,220
1954	1,040	50	330	150	730	2,300
1955	1,920	200	880	650	750	4,400
1956	1,640	40	630	730	1,400	4,440
1957	1,930	80	1,500	1,200	620	5,330
1958	1,400	60	550	730	1,480	4,220
1959	1,650	30	920	660	810	4,070
1960	2,580	160	320	260	730	4,050
1961	2,690	110	750	540	1,350	5,440
1962	1,880	170	790	810	1,150	4,800
1963	5,030	650	2,020	1,640	2,160	11,500
1964	2,660	280	940	690	1,500	6,070
1947-1964	29,910	2,080	11,240	9,610	16,970	69,810
Average	1,660	160	620	530	940	3,880

*Figures to nearest ten fish

Based on unpublished data from Washington State Game Department, Olympia, Washington

Table 9. Winter run steelhead sport catch in Eastern Olympic Peninsula Area, 1947-1964, estimated from punchcard returns.

*Number of fish, by river

Winter Beginning	Dungeness	Quilcene	Dosewallips	Duckabush	Skokomish	Olympic Peninsula Area Total
1947	360	-	70	20	150	600
1948	370	-	120	70	280	840
1949	260	-	30	70	350	710
1950	740	-	90	150	860	1,840
1951	420	-	170	190	730	1,510
1952	740	140	330	500	760	2,470
1953	2,600	110	800	550	1,160	5,220
1954	1,040	50	330	150	730	2,300
1955	1,920	200	880	650	750	4,400
1956	1,640	40	630	730	1,400	4,440
1957	1,930	80	1,500	1,200	620	5,330
1958	1,400	60	550	730	1,480	4,220
1959	1,650	30	920	660	810	4,070
1960	2,580	160	320	260	730	4,050
1961	2,690	110	750	540	1,350	5,440
1962	1,880	170	790	810	1,150	4,800
1963	5,030	650	2,020	1,640	2,160	11,500
1964	2,660	280	940	690	1,500	6,070
1947-1964	29,910	2,080	11,240	9,610	16,970	69,810
Average	1,660	160	620	530	940	3,880

*Figures to nearest ten fish

Based on unpublished data from Washington State Game Department,
Olympia, Washington

Table 10. Winter run steelhead plants in Washington State, and Puget Sound, 1939-1966

Numbers of fish, by area*

	Washington State	Puget Sound (23 rivers)	Washington State minus Puget Sound
1939	5,622,000	-	5,622,000
1940	3,643,000	-	3,643,000
1941	2,667,000	-	2,667,000
1942	1,579,000	-	1,579,000
1943	1,387,000	-	1,387,000
1944	-	-	-
1945	1,004,000	831,000	173,000
1946	1,076,000	715,000	361,000
1947	749,000	651,000	98,000
1948	787,000	589,000	198,000
1949	1,170,000	877,000	293,000
1950	1,075,000	757,000	318,000
1951	605,000	361,000	244,000
1952	-	588,000	-
1953	-	626,000	-
1954	-	636,000	-
1955	-	572,000	-
1956	-	626,000	-
1957	-	569,000	-
1958	-	550,000	-
1959	-	515,000	-
1960	-	1,088,000	-
1961	-	543,000	-
1962	-	624,000	-
1963	-	729,000	-
1964	-	812,000	-
1965	830,000	856,000	-
1966	-	836,000	-
Total		14,951,000	
Mean		680,000	

* Figures to nearest 1000 fish

Based on unpublished data from Washington State Department of Game, Olympia, Washington

Table 11. Winter run steelhead plants in Puget Sound, Hood Canal, and Grays Harbor Area, 1945-1966.

Numbers of fish, by rivers*

Year	Dose-wallips	Dungeness	Duckabush	Green	Nisqually	Nooksack	Pilchuck	Puyallup	Quil-cene
1945	-	160,000	-	47,800	-	11,800	29,100	37,700	-
1946	-	200,000	-	63,900	-	25,100	30,000	65,900	-
1947	-	-	-	105,300	-	6,100	-	177,600	-
1948	-	-	-	76,800	-	45,800	46,400	50,000	-
1949	-	-	-	122,800	-	66,700	10,000	253,000	-
1950	10,000	-	9,800	108,700	-	17,700	-	284,000	-
1951	11,200	-	12,300	79,400	-	35,800	-	60,000	5,700
1952	7,100	-	6,800	61,200	-	6,500	-	154,700	-
1953	8,800	-	6,900	64,200	-	-	-	71,000	7,700
1954	16,700	29,000	20,000	80,000	-	-	10,000	48,300	12,900
1955	35,000	33,500	34,000	75,000	-	-	10,000	70,300	5,200
1956	25,600	15,100	25,000	99,500	-	7,300	18,000	61,000	14,200
1957	-	-	25,200	60,900	-	5,000	15,000	80,800	6,100
1958	28,600	-	-	62,200	22,800	-	22,300	50,000	-
1959	18,000	-	12,300	74,400	-	8,100	20,000	64,000	-
1960	15,000	-	10,400	68,600	20,300	-	25,000	79,700	-
1961	16,700	-	12,800	69,700	19,100	19,600	24,300	57,200	10,000
1962	20,000	19,500	20,200	70,600	-	-	20,600	65,800	10,000
1963	37,000	18,000	20,000	90,000	-	-	25,000	63,000	10,000
1964	37,000	-	21,000	77,000	17,000	-	20,000	94,000	10,000
1965	20,000	13,000	13,500	87,300	25,000	-	26,000	65,000	10,000
1966	11,000	15,000	-	-	66,300	-	48,000	100,000	-
1945-1966	317,700	503,100	250,200	1,645,000	170,500	255,500	399,700	2,053,000	101,800
Mean	19,900	55,900	16,700	78,300	28,410	21,300	23,500	93,300	9,300

*Figures to nearest 100 fish

Based on unpublished data from Washington State Game Department, Olympia, Washington

Table 11 - continued. Winter run steelhead plants in Puget Sound, Hood Canal, and Grays Harbor Area, 1945-1966.

Numbers of fish, by rivers*

Year	Samish	Sammamish	Sauk	Skagit	Skokomish	Skykomish	Snoqualmie Tokul Cr. & Raging River	Stilla-guamish	Stilla. N.Fork	Tolt	Total
1945	3,500	-	-	19,800	-	95,400	156,500	214,500	24,300	30,500	830,900
1946	-	-	-	46,300	-	70,000	121,000	48,300	15,600	29,000	715,100
1947	17,400	-	67,700	17,000	-	42,000	118,200	54,500	21,300	24,000	651,100
1948	45,900	-	-	61,500	-	29,500	105,800	95,600	-	28,000	588,800
1949	85,300	-	-	138,300	5,000	51,500	19,900	34,900	16,000	25,000	877,400
1950	60,000	-	-	99,800	-	87,600	26,300	14,400	-	23,500	756,800
1951	12,100	-	-	26,900	-	41,900	33,400	20,600	-	15,500	361,300
1952	19,200	-	-	198,100	-	49,700	25,500	10,000	-	21,000	589,800
1953	40,800	14,300	-	137,100	25,500	162,000	4,800	12,500	21,200	49,100	625,900
1954	29,400	24,700	25,000	155,000	7,400	57,200	48,000	36,800	11,000	25,000	636,400
1955	43,700	10,400	20,000	42,600	50,000	61,300	35,800	20,000	10,000	15,200	572,000
1956	42,600	20,000	21,500	50,000	-	80,700	75,000	20,400	15,000	24,500	626,400
1957	30,000	15,000	20,800	40,200	26,000	38,000	54,400	71,100	-	20,000	569,000
1958	61,800	20,000	20,000	47,000	-	40,500	22,500	103,000	-	27,500	595,100
1959	43,900	20,100	20,500	43,000	16,400	90,800	30,000	34,000	-	20,000	515,500
1960	43,500	20,000	40,800	630,000*	25,000	56,600	30,000	2,500	-	20,500	1,087,900
1961	49,400	21,600	14,000	82,000*	22,000	73,000	30,000	-	-	21,800	313,800
1962	57,700	20,100	15,000	122,000*	15,500	106,000	42,000	-	-	19,000	397,300
1963	57,000	20,200	24,000	74,000*	-	106,000	82,100	-	40,000	63,000	466,300
1964	56,000	27,000	20,000	191,000*	21,000	125,000	50,000	-	-	46,000	536,000
1965	57,000	22,000	20,100	143,500*	14,700	140,000	54,000	-	102,000	42,500	595,800
1966	53,000	15,000	25,000	254,000*	31,100	117,000	25,000	-	-	75,300	596,400
1945-1966	910,200	270,400	354,400	2,619,100	259,600	1,721,700	1,190,200	793,100	276,400	665,900	13,505,000
Mean	41,400	12,290	16,100	119,100	11,800	78,300	54,100	36,100	12,600	30,300	613,900

*Includes Barnaby Slough plants

Table 11 - continued. Misc. plants.

Number of fish, by river*

Year	Carbon	Snohomish	South Fork, Stilly	White (Stuck)
1948	3,500	-	-	-
1949	-	-	-	49,000
1950	-	-	15,000	-
1951	6,500	-	-	-
1952	20,000	-	-	-
1956	-	-	-	11,000
1957	-	60,900	-	-
1958	6,000	60,900	-	-
1948-1958	36,000	121,800	15,000	60,000

*Figures to nearest 100 fish

Figure 1. Map of Northwestern Washington State, Showing locations of Twenty-eight Major Winter Steelhead Rivers.

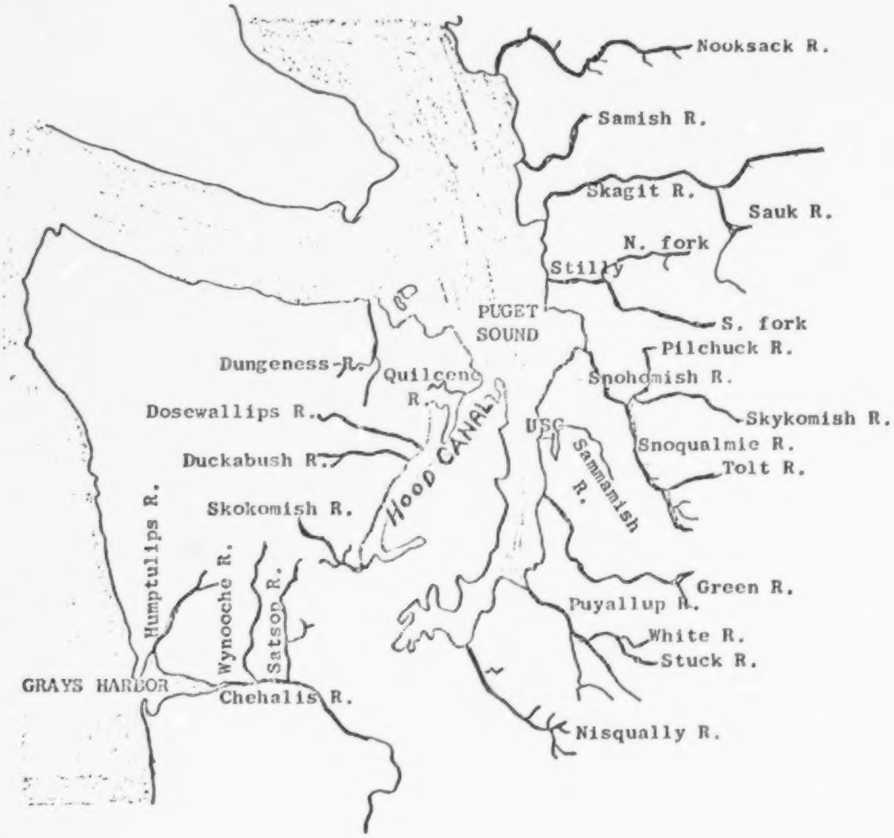

Nooksack R.
Samish R.
Skagit R.
Sauk R.
N. fork
Stilly
S. fork
PUGET SOUND
Pilchuck R.
Dungeness R.
Quilcene R.
Snohomish R.
Dosewallips R.
Skykomish R.
USC
Snoqualmie R.
Duckabush R.
Tolt R.
Sammamish R.
HOOD CANAL
Skokomish R.
Humptulips R.
Wynooche R.
Satsop R.
Green R.
Puyallup R.
White R.
Stuck R.
GRAYS HARBOR
Chehalis R.
Nisqually R.

Figure 2. Comparison of Winter Run Steelhead Plants and Sport Catch in the Puget Sound Drainage, 1945-1966. Based on data from Washington State Game Dept., Olympia, Wash.

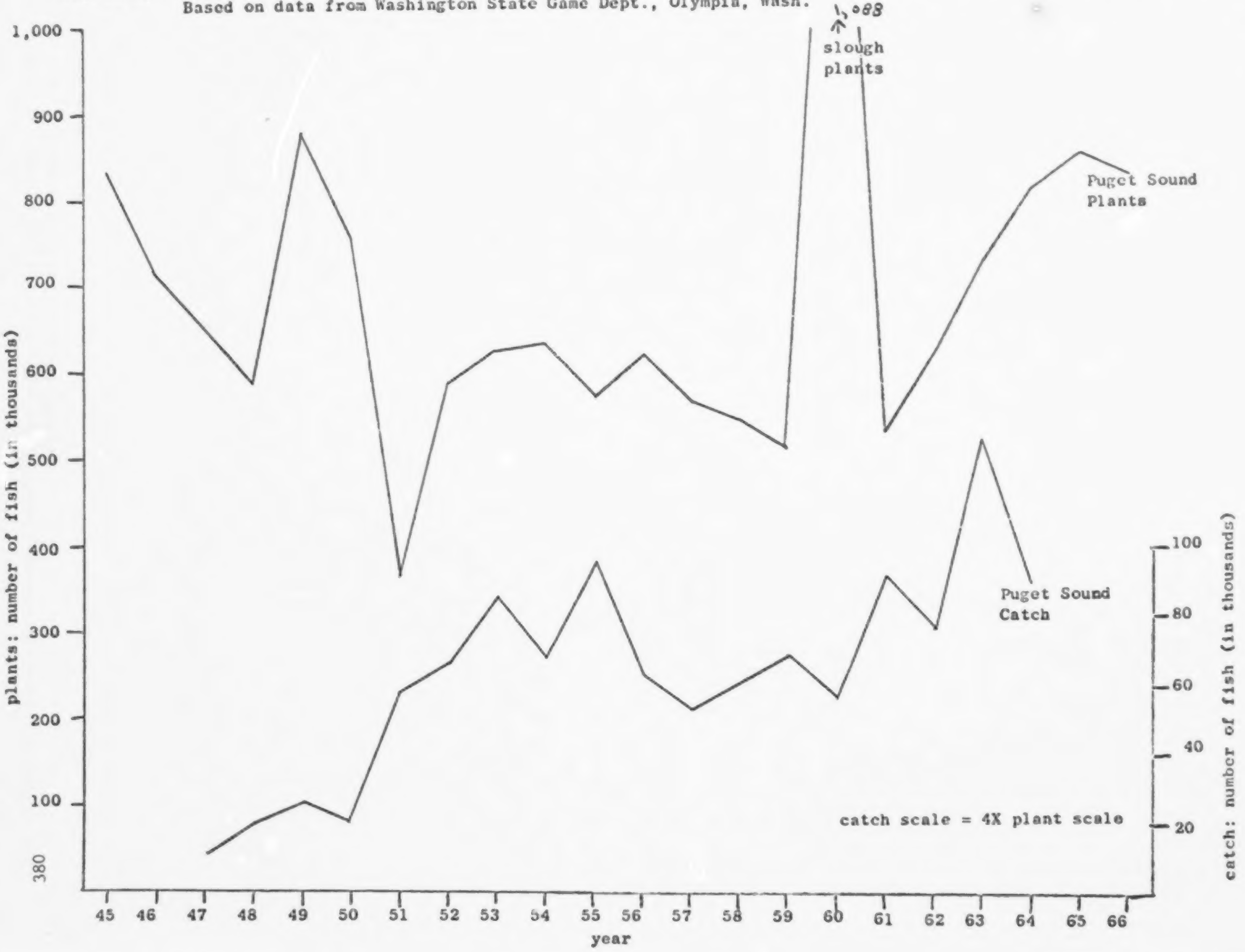
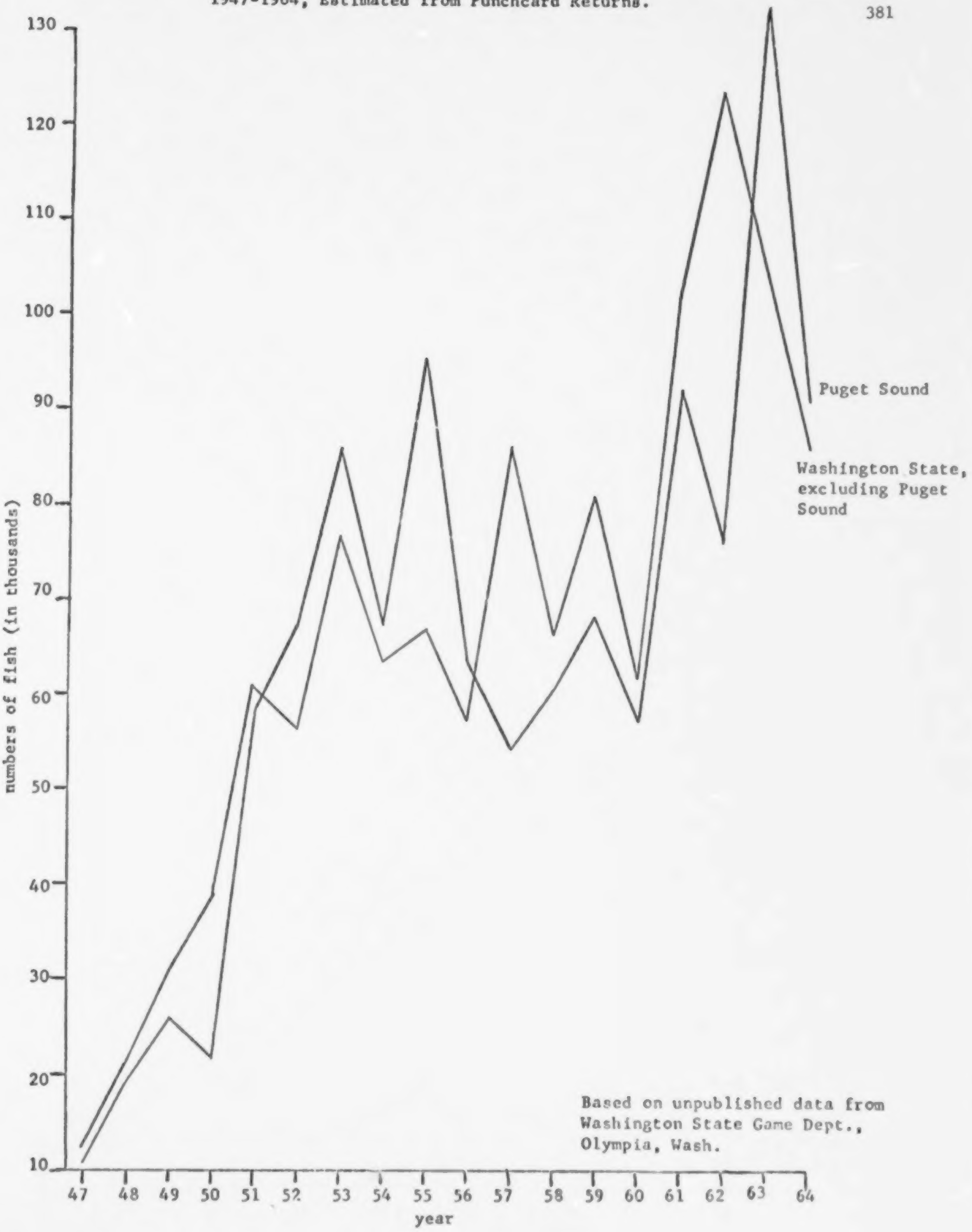
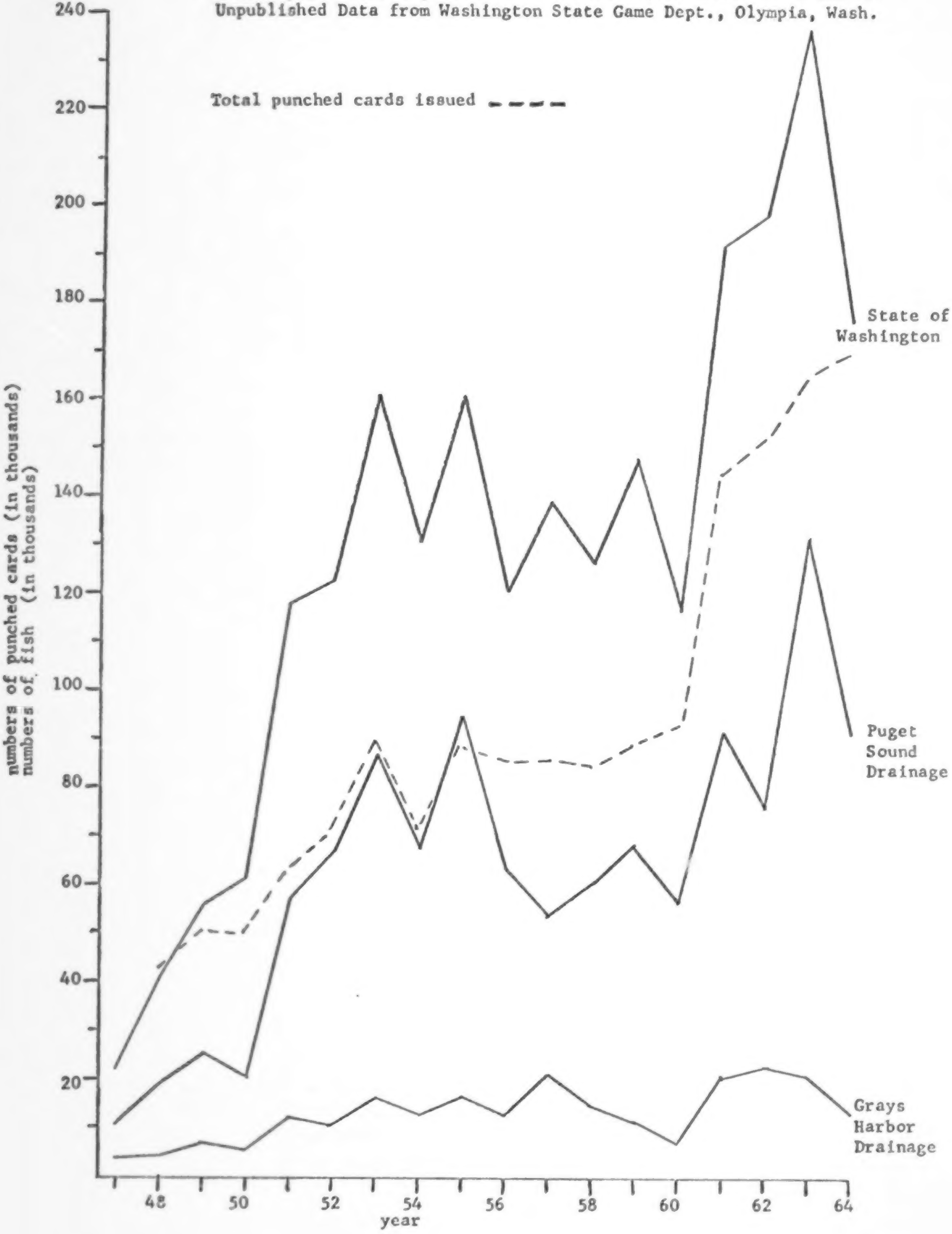


Figure 3. Winter Run Steelhead Sport Catch in Puget Sound and Washington State, 1947-1964, Estimated from Punchcard Returns.



Based on unpublished data from Washington State Game Dept., Olympia, Wash.

Figure 4. Winter Run Steelhead Sport Catch in State of Washington and Its Major Waterways, 1947-1964, Estimated from Punchcard Returns. Based on Unpublished Data from Washington State Game Dept., Olympia, Wash.



Appended Report

In the course of collecting data for this report on the trends of the steelhead sportscatch in the State of Washington, a good deal of information was tabulated and graphed that was not included in the main body of the report. It was felt that inclusion of all of the data and figures would be repetitive. Yet these data could be of interest and value to some group with a special interest in a particular stream and watershed. This information is appended and is discussed briefly.

Figure 1. Winter run steelhead sportscatch in the Humptulips and Chehalis Rivers of the Grays Harbor watershed (Refer also to Table 2 and 3 of the main report). This figure diagrams the increases in catch in the Humptulips River and the Chehalis River. It is of interest to note that the catch in the Humptulips quickly rose to a high level and the catch is characterized by wide fluctuations from over 11,000 fish in 1957 to less than 4,000 fish in 1960. The catch on the Chehalis has reached a level about 6,000 fish - a catch double that of the late 1940's - and has fluctuated around a mean of about 6,000 fish since the early 1950's. These high catches of the Humptulips can be partially explained by the large plants in the Humptulips but the variation in catch cannot be explained by our data. The irregularity of catch in the Chehalis is partially explained by the irregularity of plants in the Chehalis. The majority of fish planted in the Chehalis system are placed in the Satsop. These plants have been of moderate size - between 15,000 to 29,000 fish from 1959 to 1966.

Figure 2 diagrams the catch data from the Dungeness, Dosewallips and Quilcene Rivers. Figure 2a - Skokomish and Duckabush. These streams too indicate an increase in catch that can be correlated with the hatchery plant program (Table 5). It is of interest to note that although the Dosewallips has been the recipient of larger plants, the Dungeness returns many more fish to the angler's creel. It is also of interest to note that the catch for all three rivers peak in 1963 in common with most of the rivers that are included in this study. There are several possible reasons for the bonanza of 1963, (1) ocean survival conditions may have been optimum (2) these returns could have been due to the plants of exceptionally healthy, well-conditioned migrants (3) weather and water conditions were such state-wide that the fish were readily available to the anglers.

Figure 3. Catch data for the Samish and Nooksack Rivers. The Samish, although a very small river, is readily accessible and is intensively fished.

As a result, it is heavily planted by the Game Department (Table 5). Its plants have averaged between 53,000 to 57,000 fish in the years 1962-1966. The Nooksack is relatively distant from the large population centers. In addition, it flows through the Nooksack Indian Reservation and is subjected to an intensive fishery by the Nooksacks. The Game Department has made very small plants in that river since 1952 and 1953 - no plants are recorded after 1961.

Figure 4 gives the catch in the Stillaguamish River system. This river is interesting for it is the only river in the Puget Sound area with an important summer steelhead fishery, and is the first river to benefit from the new pond or "slough" rearing technique which was subsequently adopted with equal success on the Skagit River. The Whitehorse ponds are on the North Fork of the Stillaguamish and the increase in catch since 1961 has been remarkable. Personal observations indicate that this trend is continuing.

The South Fork of the Stillaguamish supports a relatively small fishery because its waters remain turbid throughout the winter except during protracted dry and cold periods which inhibit the erosion of the clay slides characteristic of the Stillaguamish drainage. Hence the fishery here is sporadic.

Figures 5 and 5a give the catch data of the Snohomish, Skykomish and Snoqualmie drainage. As indicated in Table 5, these streams have been heavily planted to accommodate the sportsmen of the Seattle and Everett areas. The trend of the sportscatch here follows the general trend remarked upon previously. The Tolt River, although receiving heavy plants, has not been productive. This is due in part to the inaccessibility of much of this river to anglers. The Skykomish and the Snohomish are paralleled by an excellent road system allowing sufficient angler pressure to harvest the available resource.

This river system drains into Everett Harbor where the fish are subjected to the environmental changes resulting from the industrial uses of this estuary. If there are any deleterious effects to steelhead resulting from these water uses, these data suggest that they are minimal.

Figure 6 diagrams the winter steelhead sportscatch in the Sammamish River and the Lake Union ship canal. Although these are probably the most atypical steelhead fishery areas in the state, and the Lake Union ship canal fishery the most specialized steelhead fishery in the area, the trends follow those of the Puget Sound area.

Figure 7 shows the steelhead catch in the Nisqually River and in the White and Stuck Rivers and the Carbon River. The Nisqually River catches follow the trend for the entire state. This is remarkable because this river has not been planted regularly according to our record. The Nisqually has been subjected to a vigorous Indian fishery and the State Game Department may have hesitated to supply the Indian fishery with fish subsidized by sportsmen's license fees.

The White and Stuck Rivers and the Carbon are tributaries of the Puyallup and have been planted only irregularly. An intensive and destructive Indian fishery in the Puyallup has no doubt discouraged a systematic planting program on these rivers.

Figure 8 depicts the data from the Green, Puyallup and Skagit Rivers which probably are the most intensive fisheries in the state. The Green and Puyallup are in the most heavily populated areas of the state, and are readily accessible by road. They support what might be called a "before work, lunch-hour, after work" fishery, in addition to the typical full-day fishery. During the weekends at some of the popular holes, finding parking space is a problem and in these same holes, fishing is an elbow-to-elbow proposition. Although the catch has increased since 1947, the catch has leveled off since about 1951 or 1952. The streams are planted at about the same level every year. It is within the realm of probability that these rivers are producing at their maximum and increases in catch must rely on an increased planting schedule.

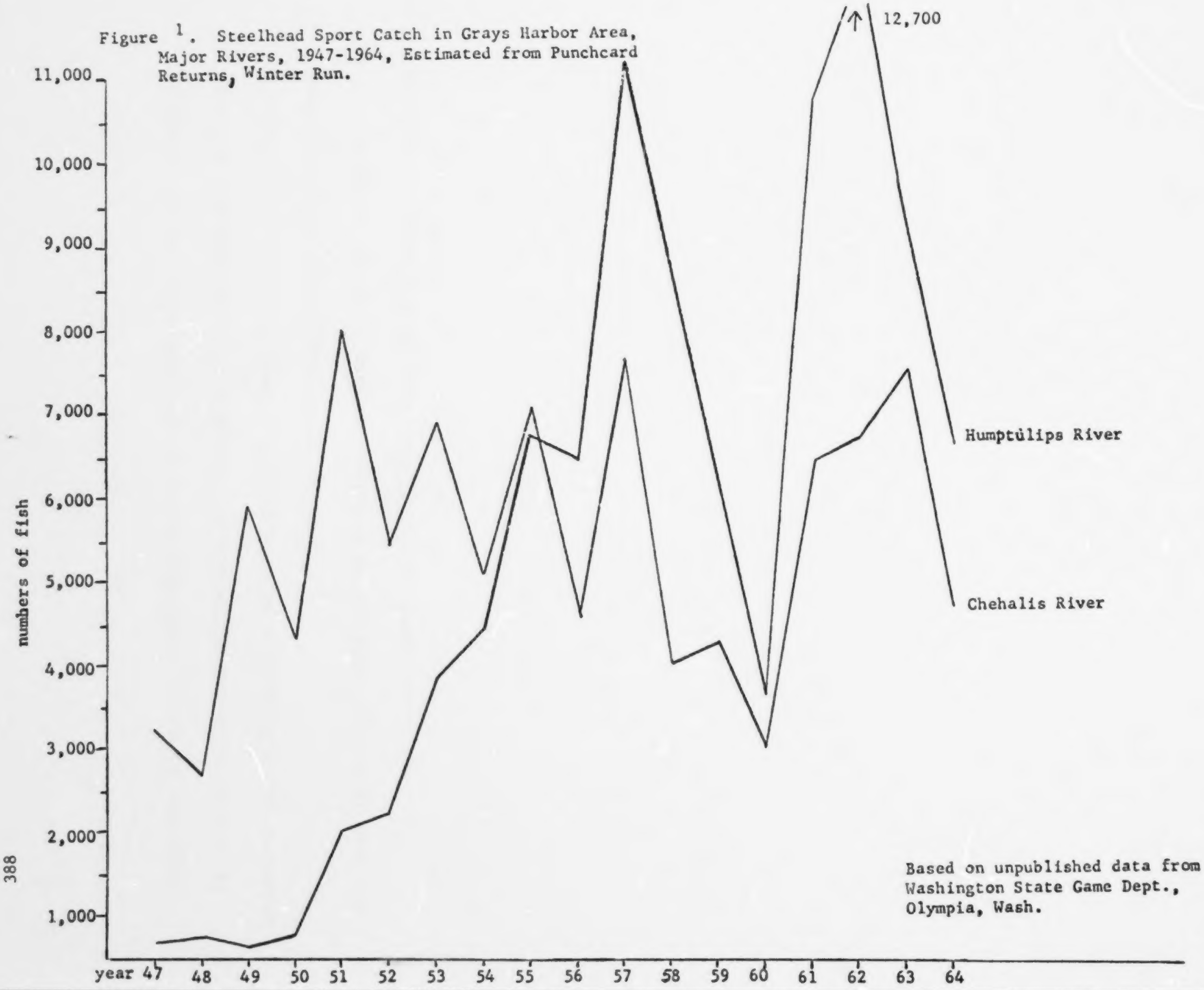
The Skagit, although a very large river, is characterized by an intensive guide boat fishery. The Skagit followed the same pattern as did the Green and Puyallup until 1962. At this time results of the Barnaby Slough hatchery operation became obvious and catches have increased to the point that the Skagit is regarded as the hot spot for Western Washington.

Figures 9 and 10 which compare the relationship between steelhead plants and catches from that plant in the Grays Harbor Drainage and the Hood Canal area raise more questions than they answer, and strongly suggest that an intensive research program is needed in order to answer some of the needs for an even more efficient steelhead management program.

In these figures the bottom lines, as labeled, indicate the catches, and the top line the plants. The catch data are multiplied by three in Table 9 and by four in Table 10 in order to enable the changes in catch to be more readily identified. The plant data are not manipulated except that they are transposed forward in time by two years. This enables us to compare the catch resulting from a particular plant. This manipulation is justified by the fact that the majority of steelhead return after two years in the ocean. For example, the plant of 1951 should return in December 1953. The planted fish are December migrants but there are significant numbers that persist in the catch through January of the next year. We have no data to evaluate the percentage that are taken in December and in January, but it is certain that these plants are predominantly December fish. In Table 9 there is a fairly good correlation between plants and returns with some glaring inconsistencies. For example, the huge plant of 1953 (perhaps a large number of fry were included) resulted in only a moderate increase in the 1955 catch. Heavy plants in 1956, 1957, 1958, resulted in below average catches in 1958, 1959, 1960. There is no data upon which one can establish the reasons for these anomalous results. On the other hand, this is not sufficient basis to seriously question the migrant plant program. To the writers of this report, it suggests that careful research studies be made to establish the variables that determine the success of the plants.

In Table 10, which compares returns in the Hood Canal area with the plants, the same lack of good correlation is observed.

Figure 1. Steelhead Sport Catch in Grays Harbor Area, Major Rivers, 1947-1964, Estimated from Punchcard Returns, Winter Run.



Based on unpublished data from
Washington State Game Dept.,
Olympia, Wash.

Figure 2. Winter Run Steelhead Sport Catch in Eastern Olympic Peninsula Area, 1947-1964, Estimated from Punchcard Returns. Based on unpublished data from Washington State Game Dept., Olympia, Wash.

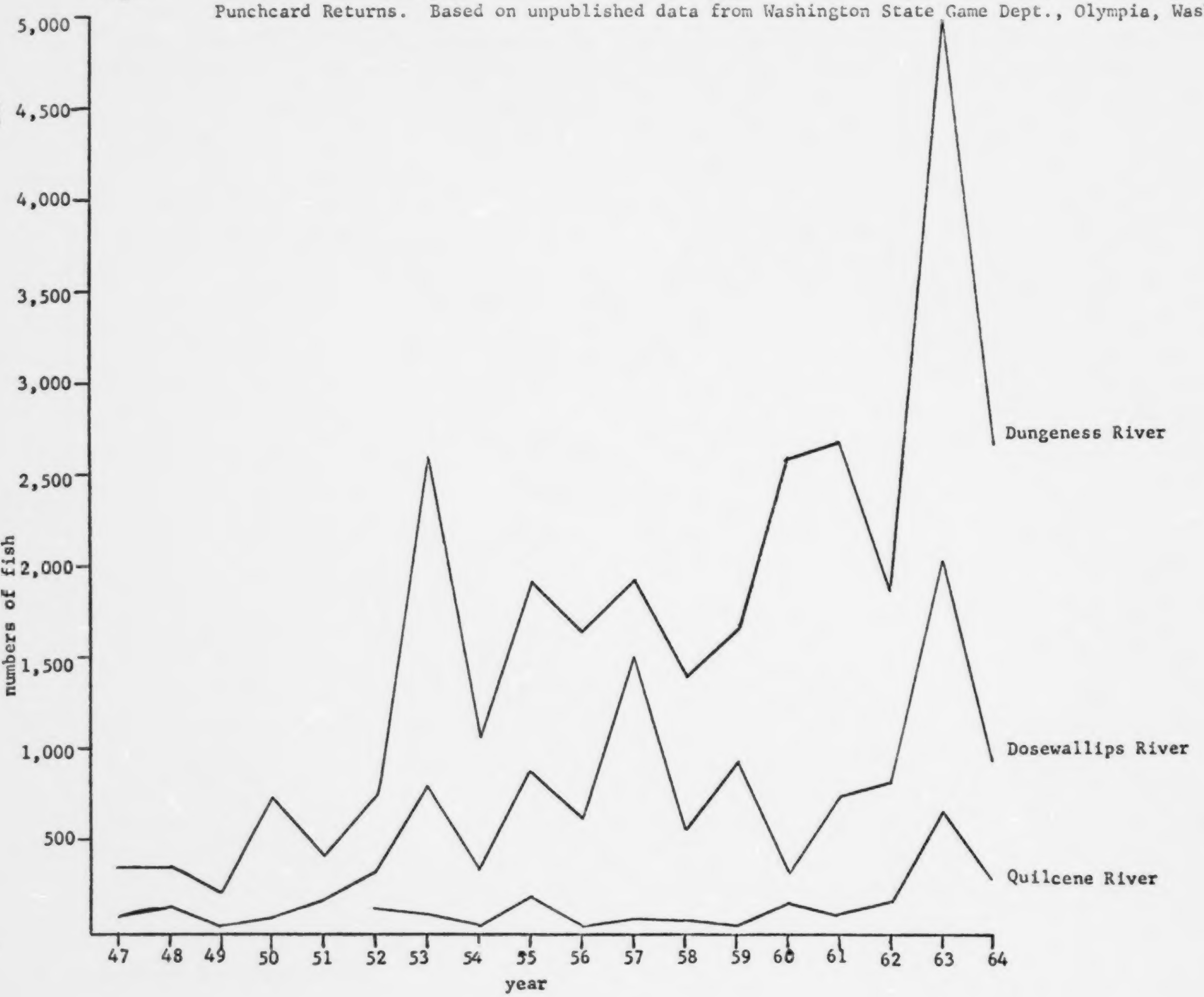


Figure 2, continued.

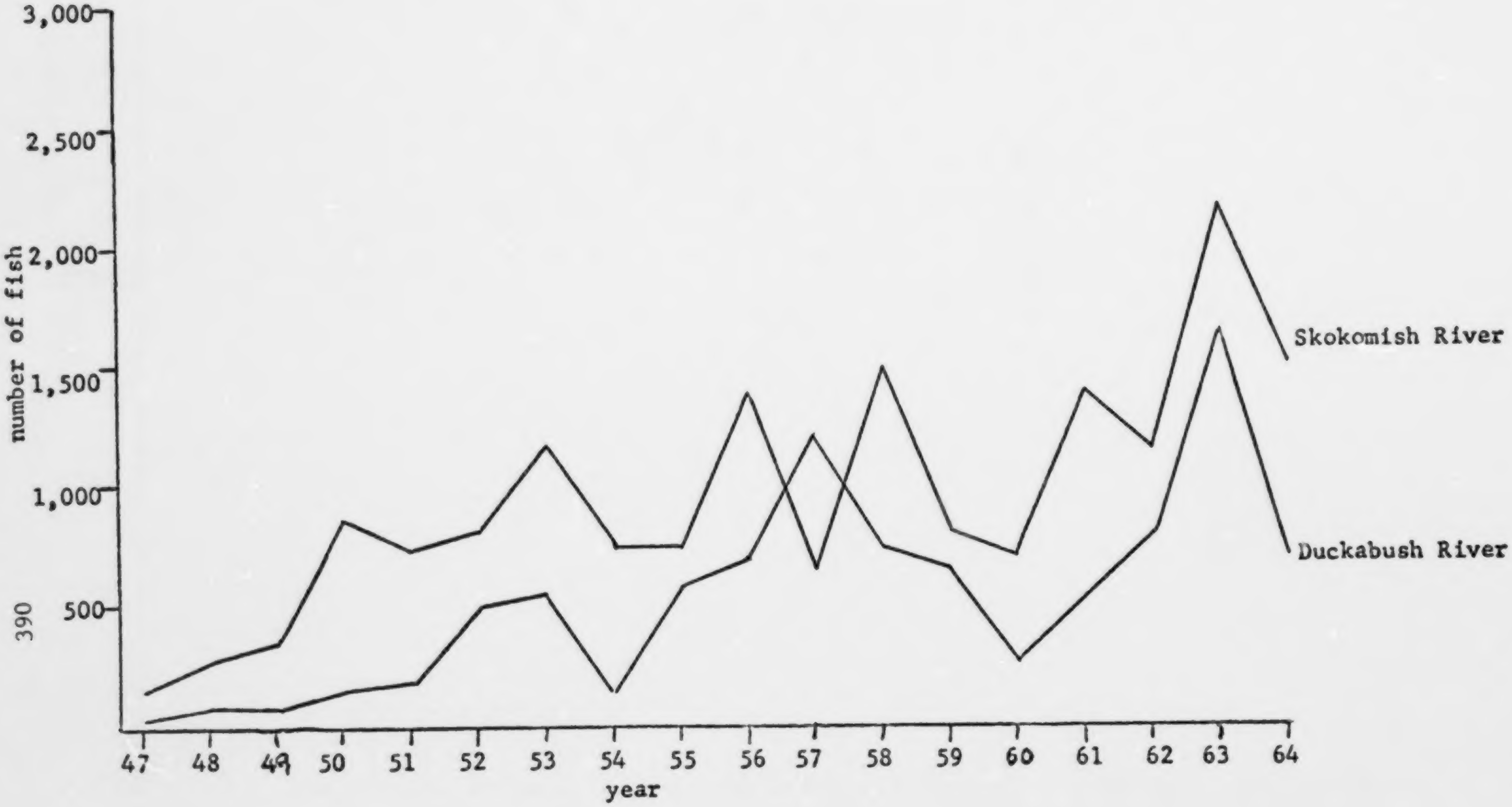
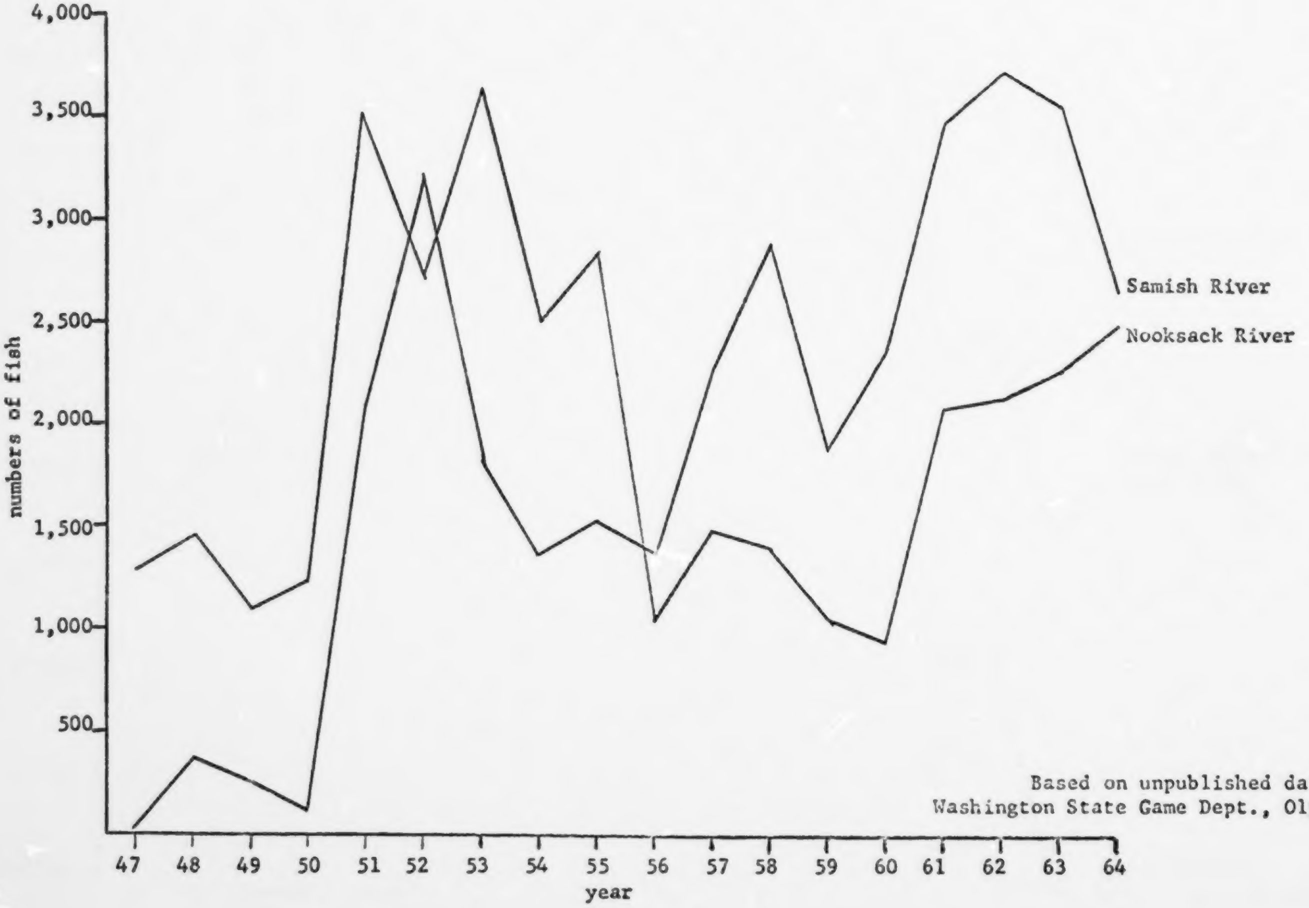


Figure 3. Winter Run Steelhead Sport Catch in Bellingham Area, 1947-1964, Estimated from Punchcard Returns.



Based on unpublished data from the
Washington State Game Dept., Olympia, Wash.

Figure 4. Winter Run Steelhead Sport Catch in Port Susan Bay Area, 1947-1964, Estimated from Punchcard Returns. Based on Unpublished Data from Washington State Game Dept., Olympia, Wash.

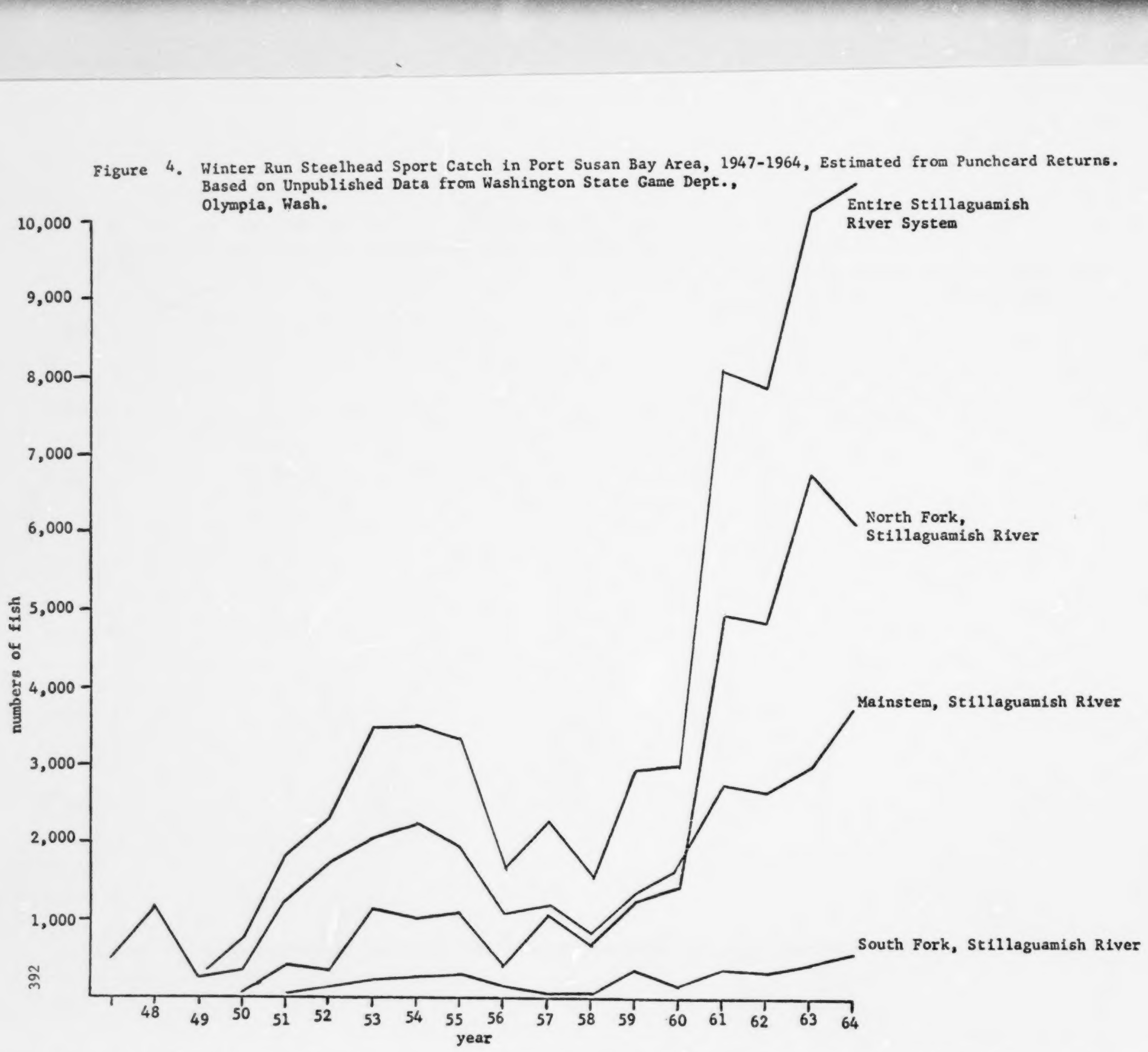
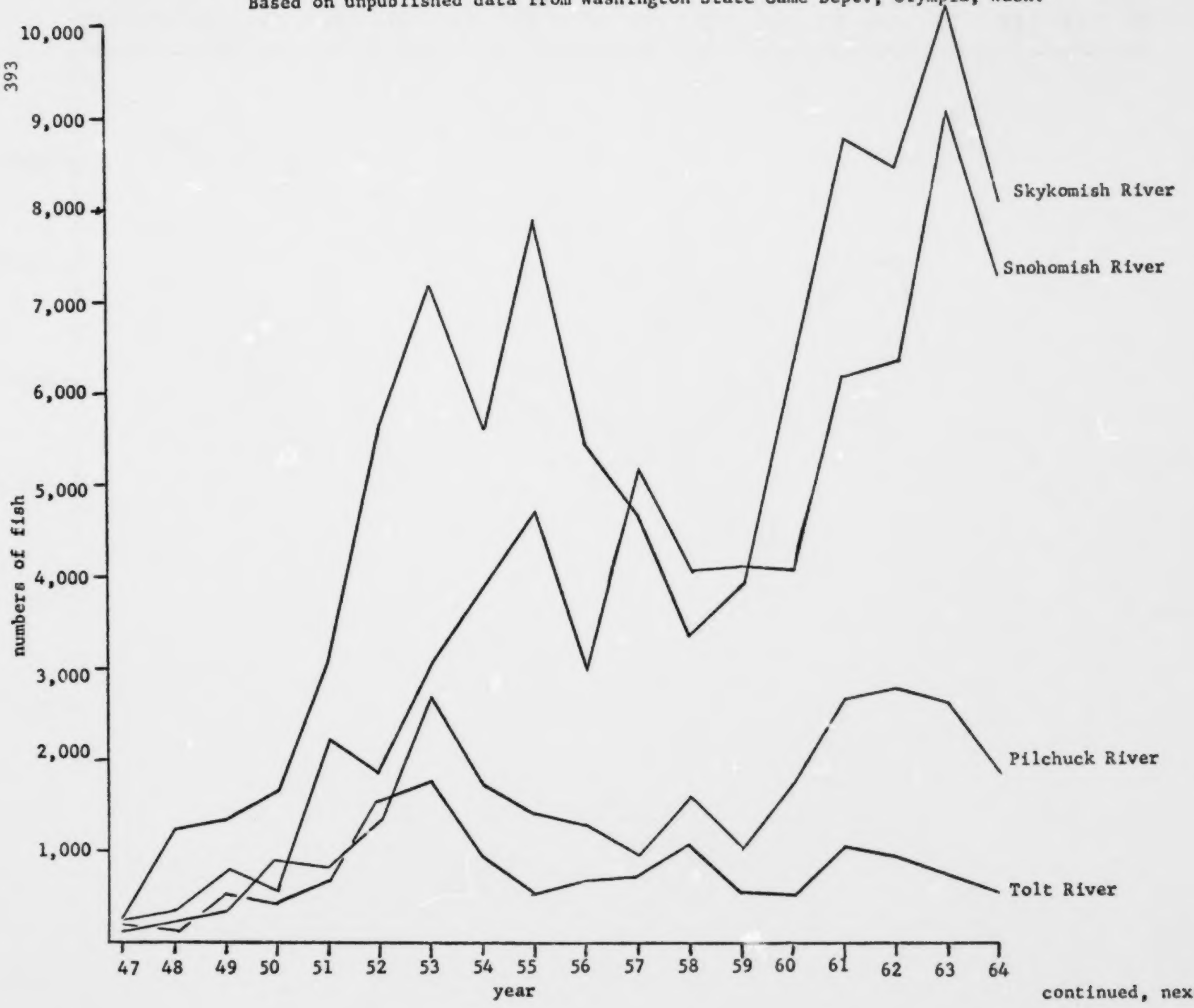


Figure 5. Winter Run Steelhead Sport Catch in Everett Area, 1947-1964, Estimated from Punchcard Returns. Based on unpublished data from Washington State Game Dept., Olympia, Wash.



continued, next page

Figure 5, Continued.

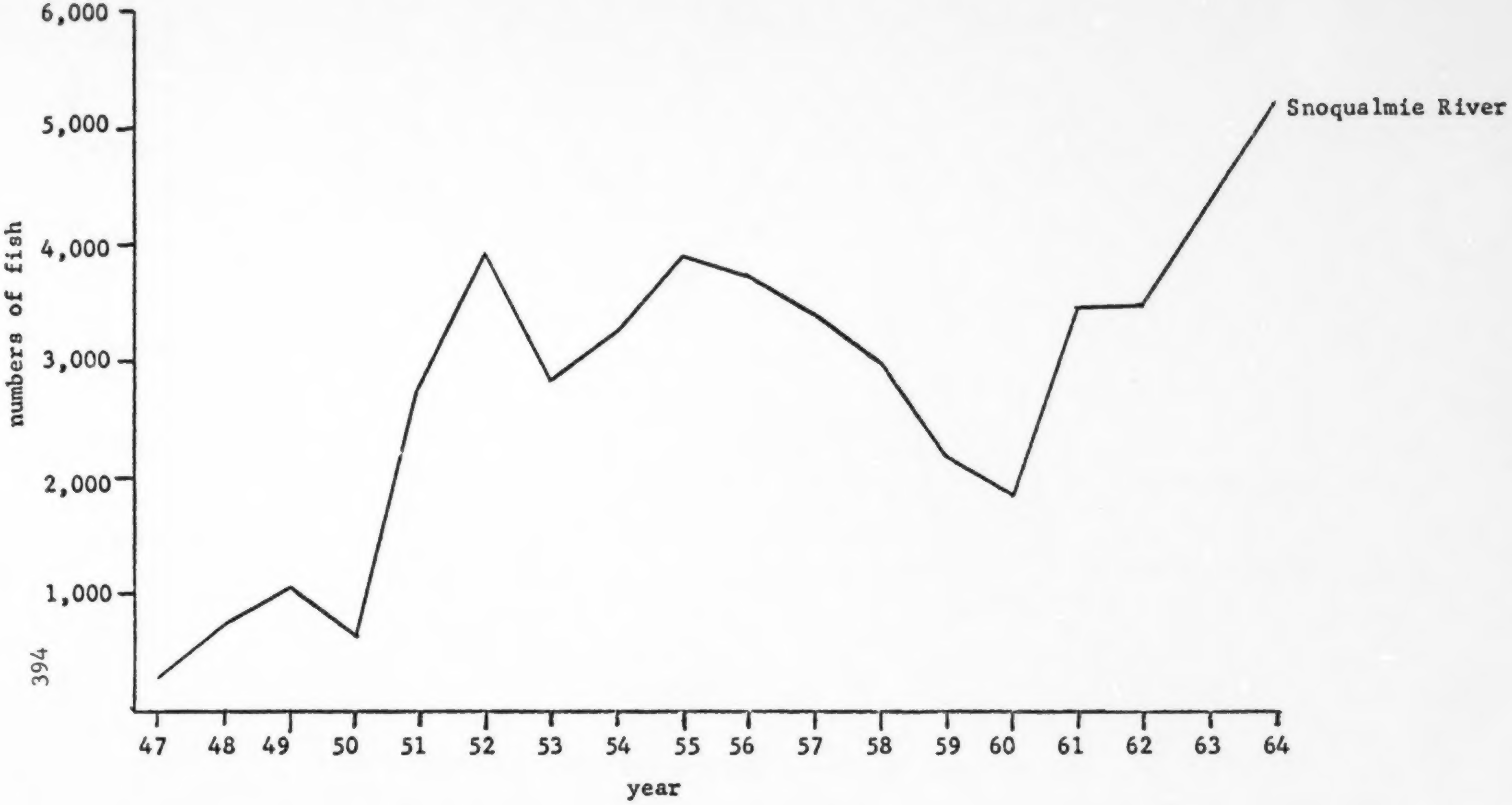
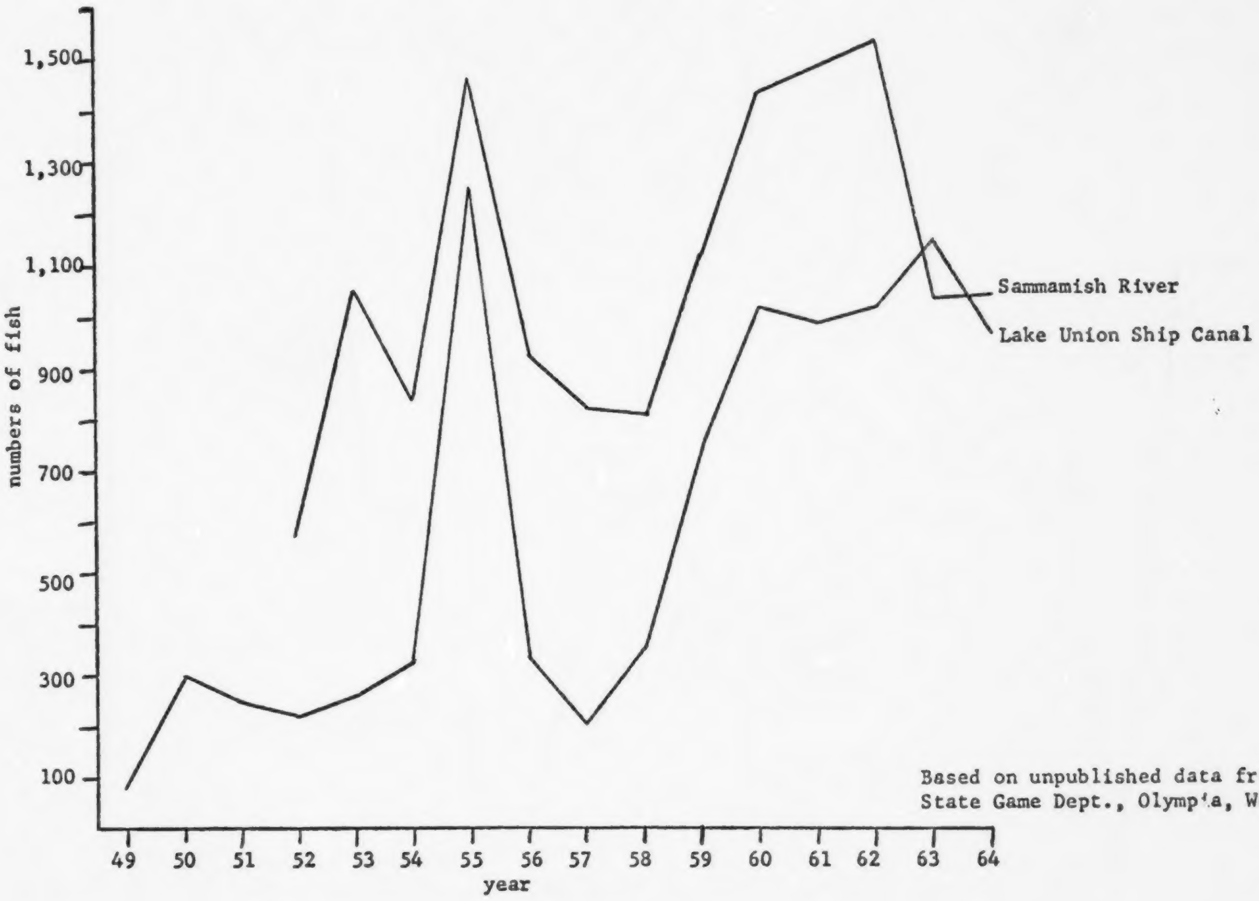


Figure 6. Winter Run Steelhead Sport Catch in Lake Washington Area, 1949-1964, Estimated from Punchcard Returns.



Based on unpublished data from Washington State Game Dept., Olympia, Wash.

Figure 7 . Steelhead Sport Catch in South Puget Sound Area, 1947-1964, Estimated from Punchcard Returns. Based on Data, unpublished, from Washington State Game Dept., Olympia, Wash. Only Winter Run is included.

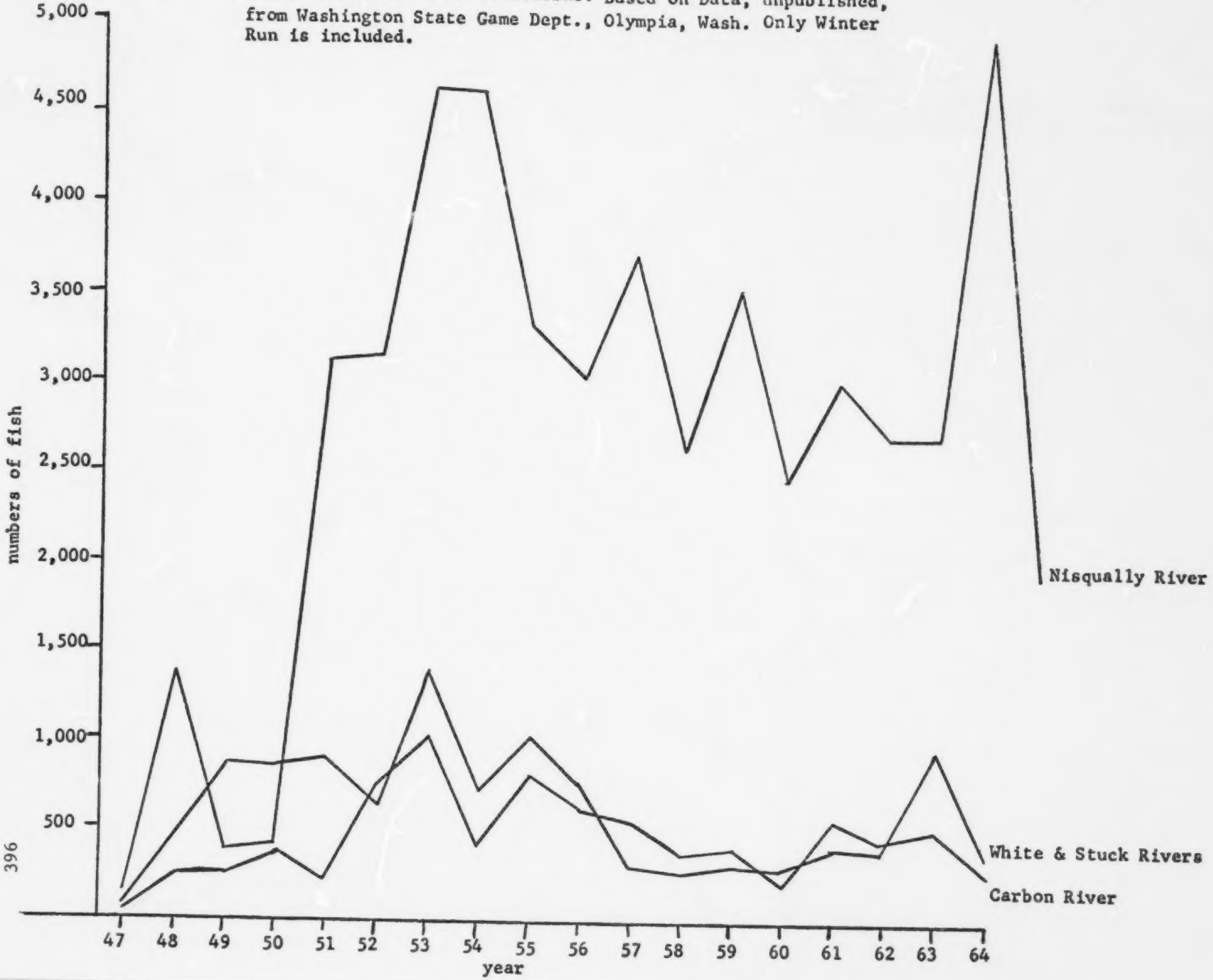
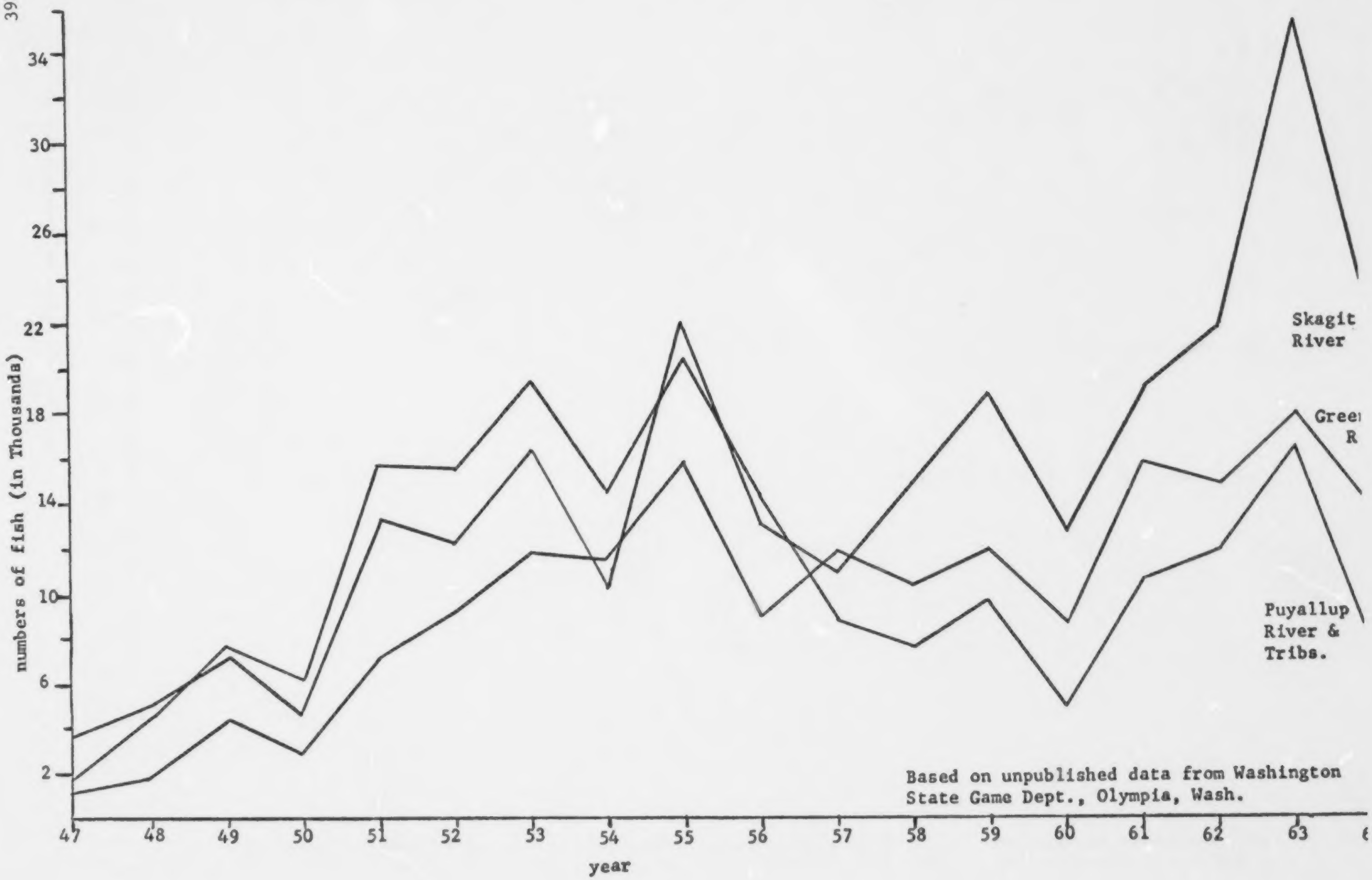
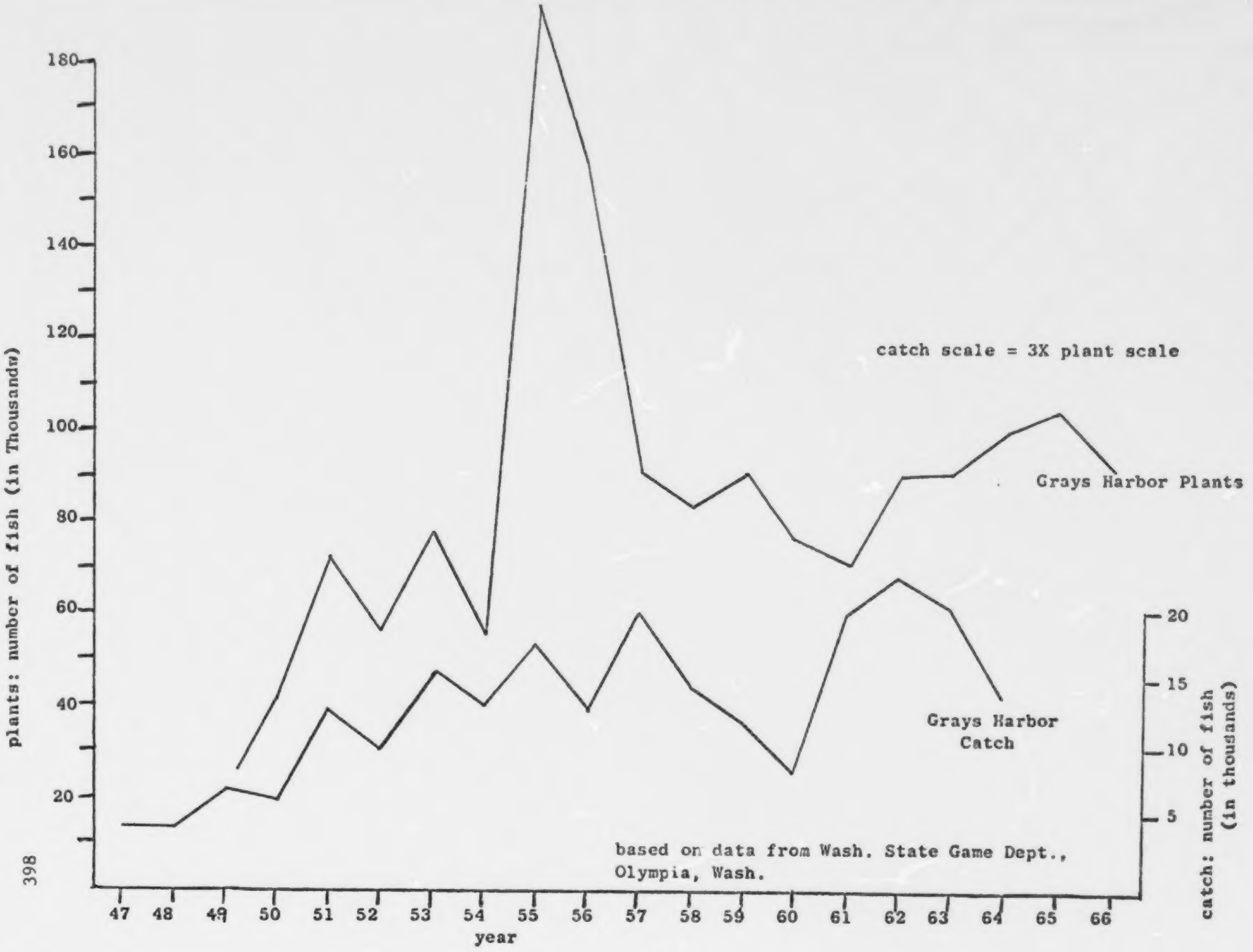


Figure 8. Steelhead Sport Catch in Puget Sound Area, Major Rivers, 1947-1964, Estimated from Punchcard Returns, Winter Run.



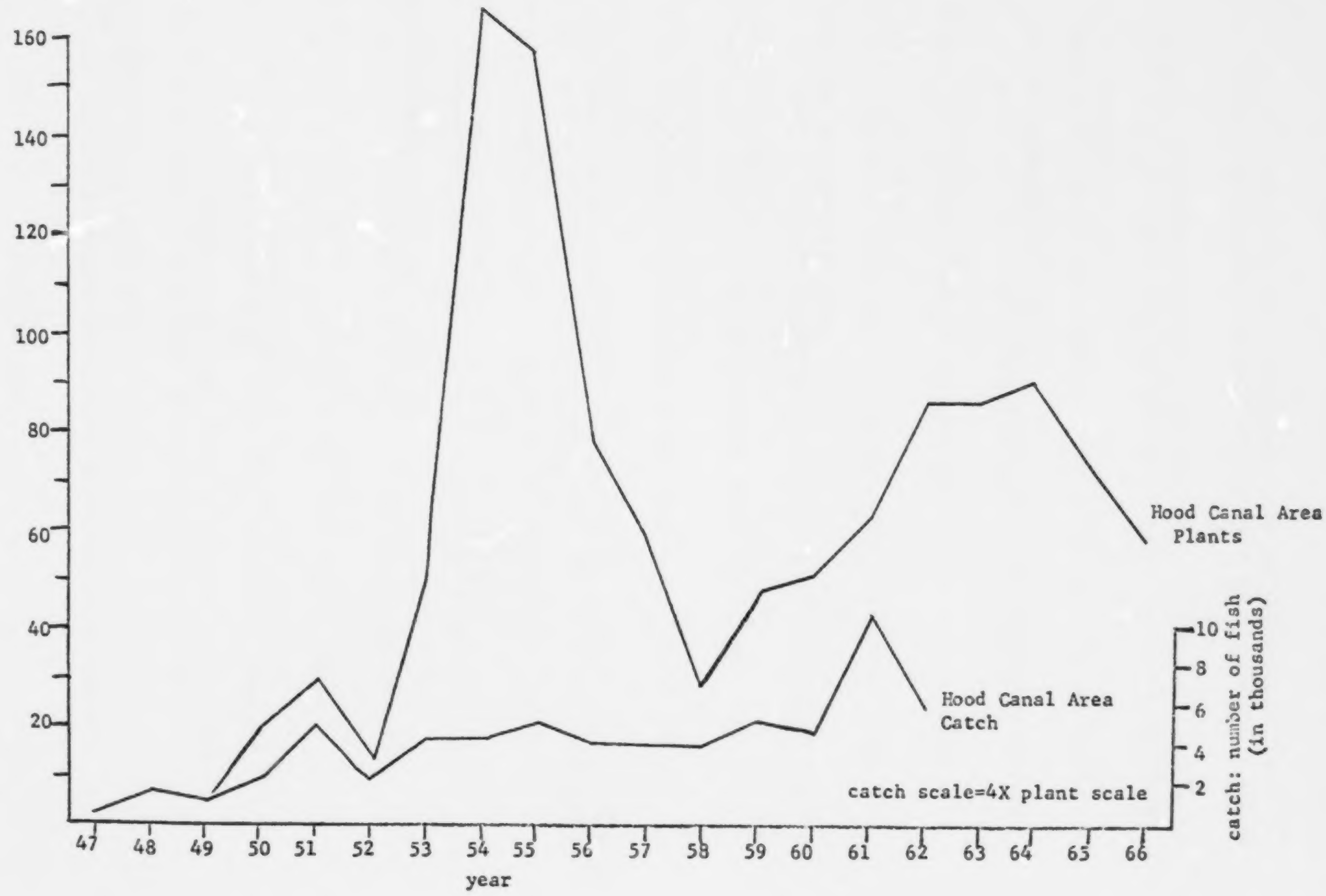
Based on unpublished data from Washington State Game Dept., Olympia, Wash.

Figure 9. Comparison of Winter Run Steelhead Plants with Sport Catch in Grays Harbor Drainage, 1947-1966. The Plant Profile is Translated Two Years Forward: 1947 plant is plotted over the abscissa, 1949.



based on data from Wash. State Game Dept., Olympia, Wash.

Figure 10. Comparison of Winter Run Steelhead Plants with Sport Catch in the Hood Canal Area, 1947-1966. The Plant Profile is Translated Two Years Forward: the 1947 plant is plotted over the abscissa, 1949. Based on Data from Washington State Game Dept., Olympia, Wash.



Hallock, R. J., 1961, An evaluation of stocking hatchery-reared steelhead rainbow trout (*Salmo gairdnerii*) in the Sacramento River system, Calif. Dept. Fish and Game, Fish. Bull. #114, 74 pp.

Hunter, W. A., E. E. Wolcott, eds., 1953, Estimated total catches of steelhead based on punchcard returns, Wash. State Dept. Game, Bull.,5(1):4.

Hunter, W. A., and E. E. Wolcott, 1953, Comparative fishermen - steelhead catch totals, 1947-53, Wash. State Game Dept. Bull., 5(2):11.

Hunter, W. A., and E. E. Wolcott, eds., 1954, Top 25 steelhead streams, 1952-53 winter season, Wash. State Dept. Game Bull., 6(1):6.

Hunter, W. A., and E. E. Wolcott, eds., 1956, His excellency, the steelhead, Wash. State Dept. Game Bull., 8(1):1,4.

Larson, R. W., and J. M. Ward, 1954, Management of Steelhead Trout in the State of Washington, Trans. Amer. Fish. Soc., 84:261-74.

McRea, A., 1952, Steelhead studies, Wash. State Dept. Game Bull., 4(1):3.

Meigs, R. C., and C. F. Pautzke, 1941, Additional notes on the life history of the Puget Sound steelhead (*Salmo gairdnerii*) Wash. State Dept. Game, Biol. Bull. #5, 13 pp.

Millenbach, C., 1963, Summary of steelhead catch during 1962, Wash. State Dept. Game Circular, unpublished, 3 pp.

Millenbach, C., 1964, Summary of steelhead catch during 1963, Wash. State Dept. Game Circular, unpublished, 4 pp.

Millenbach, C., 1965, Summary of steelhead catch during 1964, Wash. State Dept. Game Circular, unpublished, 4 pp.

Millenbach, C., 1966, A management program for steelhead trout, Wash. State Dept. Game Bull., 18(1):4-5.

Millenbach, C., 1966, Steelhead fishing in Washington, Wash. State Game Dept. Circular, unpublished, 9 pp.

Millenbach, C., 1966, Summary of steelhead catch during 19 65, Wash. State Dept. Game Circular, unpublished, 4 pp.

_________, 1962, Winter season steelhead punchcard record, Wash. State Dept. Game Pamphlet, unpublished, 5 pp.

Pautzke, C. F., and R. C. Meigs, 1949, Studies on the life history of the Puget Sound steelhead (*Salmo gairdnerii*), Wash. State Dept. Game, Biol. Bull. #3, 24 pp.

Tollefson, R., 1960, Winter steelhead-Washington-fluctuations and trends, A report to the West Tacoma Newsprint Co. and the N.W. Pulp and Paper Assoc., unpublished, 17 pp.

Shapovalov, L., and A. C. Taft, 1954, The life histories of the steelhead rainbow trout and silver salmon with special reference to Waddell Creek, California, and recommendations regarding their management, State of Calif. Dept. of Fish and Game, Fish. Bull. #98, 375 pp.

APPENDIX E

SUICIDE IN THE SHALLOWS*

by
Wesley Marx

A mile from my home in California lies a cradle of the sea called Upper Newport Bay.

Marsh grass rims this cradle; a shallow blue-green sheet of water covers its mud-flat bottom. I cannot see them but within the blue-green water dart thousands of tiny, wriggling forms of life which will grow into the ocean's next generation of fish. For eons, the young of the ocean have been borne here by their parents or by ocean currents that meander in from off-shore spawning grounds.

Yet much of this sea cradle will soon lie beneath a blanket of dirt. Its gravestone will be a luxury home development whose occupants may someday wonder why the oceans off the United States no longer abound with tarpon, snook, croaker, menhaden, flounder, bluefish, drum and life in general.

This sterile spectre arises from a misconception of incalculable consequences. While the ocean regime may appear to halt at the shore in the crescendo of surf, its vital processes infiltrate quietly into our bays, sloughs, inlets, sounds, salt marshes and lagoons. These rambling coastal niches, where salt water meets the sweet water of land, are called "estuaries". While some estuaries, such as the glaciated fjords of Alaska--are on the grand form, most are sprawling mazes clogged with marsh grass, criss-crossed by channels and bottomed with mud. Yet these rather mundane-appearing places must rank with our forests and our rivers as indispensable natural resources. Neither of the latter two can come close to matching the life-giving capacity of the estuary.

This capacity springs from the surprisingly calm collision of sea and land forces that characterize an estuary. Here ocean tides and river currents circulate enriching nutrients. An estuary is nature's grand nutrient trap. The shallow, sprawling nature of the estuary provides maximum exposure to energy-giving sunlight. Amidst these optimum conditions, the rooted plants of the land and the drifting plants of the sea (plankton) combine in a virtual explosion of organic productivity. Thick beds of salt meadow grass, spike grass, sea lavender, switch grass, bulrushes, cordgrass, cattails and sweet grass thrust up from mud mazes.

More productive than land. The noted ecologist Eugene Odum finds that estuaries are twenty times as productive of food as the open sea, seven times as productive as an alfalfa field and twice as productive as a corn field. And all this accomplished without the aid or attention of man.

Published in the June-July 1968 issue of the National Wildlife Federation magazine "National Wildlife".

The person who stands beside a salt marsh reveling in its solitude is actually standing beside a powerful biological engine driven relentlessly by winds, tides, currents and sunlight. It is this organic productivity which the ocean regime finds so vital in nurturing marine life. On the open sea, young fish must forage over great distances for fare while dodging sharks and other marine bullies. In an estuary, currents serve to concentrate food matter for young fish while eelgrass shields them from bullies.

Besides nursing tarpon, flounder, bluefish and crustacea like shrimp, the estuary serves as a complete habitat for other marine forms. Minute diatoms swirling about in the tidal flux may suddenly find themselves impaled on the sticky gills of a creature that pumps eight gallons of estuarine water through its system each hour--the oyster. The nutrients extracted by this pumping nurture his soft meat and hard shell. Clams, scallops and mussels are other shellfish who need move little or not at all amidst the swirling richness of the estuary.

To another spectrum of marine life, the estuary is a vital gateway--if not an enriching stopover--between river spawning grounds and oceanic pastures. Anadromous fish like salmon, shad, striped bass, alewives and sturgeon all pass through estuaries, first in the body of a parent, then on their own fledgling fins.

Support birds, too. From the sky above descends another spectrum of marine life, the shore birds. And song birds and waterfowl as well. "Whistling swans play hopscotch across the Great Lakes every fall to enjoy the wild celery in Chesapeake Bay," observes Dr. Alfred Etter. "The teeming life of coastline mudflats provides the energy for godwits, curlews, sandpipers and plovers to appear on the Great Plains a few days later, hungry for grasshoppers."

The estuaries, with their life-giving capacity, are thus as vital a part of the ocean regime as the tide-nudging moon. Yet traditionally we have not appreciated this factor, even though two-thirds of our ocean catch is estuary dependent.

Much of our population lives on or near the coastline, and a tragic collision between human geography and natural geography results. San Francisco Bay makes the San Francisco-Oakland area one of the most charming urban regions in the world--part peninsula and part ocean bay. The Bay also once served as a vast cradle of the sea.

At one time, the Pacific Coast's largest commercial fishing fleet docked in the Bay. Yet today no commercial fishermen seine the sunlit shallows. As a civic cesspool, the Bay receives the discharges of over 80 sewage outfalls. Daily, some 60 tons of oil and grease form rainbow slicks and paralyze the nerves of striped bass. Acid wastes burn salmon gills. Chemical effluents disrupt the normal development of fish eggs and fishermen catch freakish flounder. Dredges bury fish habitat under silt avalanches.

As garbage dumps, marshes that once nurtured eelgrass now exude the rotten-egg smell of putrification. As a real estate reservoir, tideland habitat now lies buried beneath apartments, shopping centers, ball parks and airport runways. A third of the Bay--some 257 square miles--has been reclaimed. The Bay that once provided 15 million pounds of oysters annually no longer supports oyster production. The Bay that once provided 300,000 pounds of clams annually no longer supports clam production. The Bay that once provided six and one-half million pounds of shrimp now only produces 10,000 pounds annually. The birthright of millions of fish has been stolen.

Goodbye, Newport Bay. The cradle of the sea near my home is much more modest in size and reputation. Yet its demise will be epochal. "Formerly six substantial marshland regions existed in Southern California," observes Professor Grover Stephens, chairman, Department of Organismic Biology at the University of California at Irvine. When the marshland is filled, the shore bulkheaded and the channels dredged for power boats in Upper Newport Bay, the last such marshland will be a memory. The inclusion of a public marina and a "marine stadium" hardly soften the hard fact that the development plans, according to a staff report by the California State lands Commission,"convert public waterways into a captive waterway primarily for the use of the private residential boat owners who would occupy the created area and dominate the bay." Recently, a citizens group formed to appeal Upper Newport Bay's fate to Federal conservation agencies, and the Corps of Engineers may hold a public hearing on issuance of a dredging permit.

On a state-wide level, 67 percent of California's estuarine habitat is a memory.

The rate of estuarine destruction on the Atlantic and Gulf coasts is lower. The estuaries in the east are not any better appreciated; it is just that there are more of them to alter. The South Atlantic and Gulf coast, from Cape Hatteras to the Mexican border, is an almost continuous estuarine area. Yet the tribulations of San Francisco Bay haunt Galveston Bay in the Greater Houston area, Florida's Tampa Bay, the Prince Inlet in the Charleston area, the Savannah River estuary in Georgia, and Pamlico Sound in North Carolina.

North of Cape Hatteras, there are fewer estuarine areas, but even more destruction. Massachusetts has lost 20 percent of its estuarine and tidemarsh habitat, according to John Clark, president of the American Littoral Society and author if "Fish and Man." Connecticut has lost 50 percent and has but 20 square miles left. Between 1954 and 1964, 29 percent of Long Island's marsh and shallow coastal habitat was "obliterated," according to the United States Fish and Wildlife Service. "Obliteration" can take many forms: Even the droppings from duck farms pollute oyster beds in Long Island's Great South Bay--and keeps oyster harvesters out of business.

What estuaries we do not bury may bury us instead. In the late 1950's New York City's hepatitis rate increased sharply. Many victims of inflamed livers remembered consuming oysters from New Jersey's Raritan Bay. They tasted oily and their meat was greenish. Oil wastes in the bay had provided the seasoning while copper wastes contributed the color. These oysters--steeped and marinated in pollution--were inflaming the livers of New Yorkers. Today, the bay oysters lie in quarantine. Nature's grand nutrient trap is becoming "a natural pollutant trap, a trap for all the environmental evils and ecological sins of man," noted Frank Di Luzio, former Assistant Secretary of the Interior for water pollution control.

Congressman Dingell speaks out. This concern has finally penetrated the corridors of Congress. "These valuable estuarine areas are rapidly disappearing from the face of this earth on this continent," observes conservationist Congressman John Dingell of Michigan, chairman of the House Subcommittee on Fisheries and Wildlife Conservation. "I think it is our responsibility to act now to save our remaining estuarine areas from the inexorable and ruthless encroachments of our modern civilization." The President's National Council on Marine Resources rates control of estuarine pollution as a priority program.

This high-level concern recognizes the need to better balance the natural and industrial values of the estuary. However, translating this concern into action can be a task of formidable magnitude. And first we must hurdle our own ignorance. While we may be able to recognize the natural values of an estuary, we don't know enough about the stresses and tolerances of the biological engine that makes it all possible. The circulatory currents that help trap food matter for young fish can't tell the difference between nutrients and pollutants. A sewage outfall that discharges fresh water, or a dam that restricts fresh water inflow, can alter the critical mix of fresh and salt water that estuarine creatures need. Thus, even fresh water can become a pollutant!

We must better understand such relationships; understand them so well that we can plot them with precision. The Department of the Interior and the Corps of Engineers are now creating a model of Chesapeake Bay, which is fed by 100 natural tributaries and a host of artificial ones, like sewage outfalls. The model will help predict and balance the impact of sewage, dredging projects and dams on the vast Chesapeake estuary. Such models are no panacea for estuarine conservation. They only reflect the sophisticated attention that estuaries need if we are intent on enjoying both their natural and industrial values. In all, some 22 fields of specialized knowledge are needed to even evaluate the character of an estuary.

Our present approach is wrong. Estuaries therefore need management as comprehensive as that given to our parks, farmland and forests. But if the biological nature of an estuary is complex and demanding, its political nature is even more so. Traditionally, estuaries have not been governed as complete marine systems but as subdivisions of political systems on land. Thus, some 90 communities and a host of private and public agencies use San Francisco Bay with little reference to each other's needs and the general health of the Bay.

Unfortunately, such exploitation is a deeply rooted custom. The landlord of an estuarine area profits little by conserving it--unless he has a fishing fleet mammoth enough to corner the fish nursed by the estuary. On the other hand, he profits greatly by altering it to such purposes as real estate development.

While formidable, the obstacles to estuarine conservation are by no means insurmountable. Concerned that San Francisco Bay would ultimately shrink into an industrial gutter, a group of interested citizens formed the Save San Francisco Bay Association. The Association helped inspire a study of the Bay's condition by Professor Mel Scott of the University of California at Berkeley. Armed with this study, the Association focused public attention on the plight of the Bay, and stressed how the general public was being deprived of the recreational and fishery values. When local officials continued to condone harmful exploitation, the Association went over their heads to the State Legislature.

In 1965, the Legislature created the San Francisco Bay Conservation and Development Commission. The Commission, composed of local, State and Federal officials, is to evolve a master plan for the Bay that relates conservation to development. The Commission is empowered to veto projects in the planning interim. This praiseworthy precaution recognizes that prolonged studies can kill estuaries just as easily as acid wastes.

The Bay is already beginning to revive under this new appreciation. Upgraded waste treatment standards have improved portions of the Bay. The clampdown on fill projects provides an opportunity to insure survival of remaining precious marshland. While formidable legal and technical problems--particularly in waste disposal--must still be solved, the Bay promises to become a symbol of protection rather than desecration. A cradle of the sea that was fast becoming a ghost cradle has won a reprieve. Fish will not be the only winners. Commercial fishermen, sport fishermen, swimmers, water skiers, bird watchers, waterfowl hunters, hikers, wildlife lovers, marine biologists and children awakening to nature will win, too. An estuary has many admirers; today it needs them as defenders.

In 1965, Massachusetts enacted a Wetlands Protective Act which empowers the State Department of Natural Resources to approve or disapprove all estuary alterations. The Act extends eminent domain power for the purchase of endangered estuaries, and also provides compensation to tidelands owners in cases where Department restrictions amount to land-taking. A tideland owner should not be made to carry the burden of maintaining what amounts to a public resource. Rhode Island has also passed similar legislation.

Congressman Eckhardt's Fight. Such foresight is commendable and, hopefully, pace-setting. (In disappointing contrast, Congressman Robert Eckhardt of Texas compares the estuary vigilance of the Texas Park and Wildlife Commission to "a gar guarding the fishing hole". The hard-driving young congressman is trying to prevent the burial of Galveston Bay's oyster fishery by the huge--and politically-powerful--shell dredging industry. Though local and State conservation groups, led by the Sportsmen's Club of Texas under Region 8 Director Henry LeBlanc, are joining the fight, they face an unusually complicated set of political and financial considerations. The companies that dredge the shells are far more powerful than their local opponents. The State Fish and Game Department enjoys a good financial return from dredging permit fees. Highway and other building projects depend on the shell for concrete. The many interests tangle into a real Gordian knot, and while conservationists work on it, the dredges continue to gouge hundreds of tons of shells from the floor of Galveston Bay, leaving in their wake a sterile trench where no live oyster can survive, and spreading a silt fallout that smothers live oyster beds for miles around their operations.

However, such hard work at State and local levels can be nullified at the Federal level. Many local and State agencies in New York now seek to halt the relentless dredging of Long Island's estuaries. Responding to this concern, the United States Fish and Wildlife Service recommended that 21 permits for dredging in the Long Island area be denied in the period between 1964 and 1966. The Corps of Engineers, responsible for issuing permits, overruled the Service in each of the 21 instances. Concluded Long Island Congressman Herbert Tenzer, "The primary responsibility of the Corps of Engineers is to insure that navigation is not impaired and as a result that agency has not protected the natural resources which reside in estuarine areas of the Nation."

Efforts are being made to let the Federal Government play a more constructive role in estuarine conservation. The Water Quality Act of 1965 authorizes the Interior Department to control pollution in estuaries as well as river systems. Secretary Stewart Udall has already convened thirteen enforcement conferences dealing with critical estuary situations, including Raritan Bay, Great South Bay and Galveston Bay. The Corps has reached a Memorandum of Understanding with the Department of Interior to pay closer attention to fish and wildlife values in granting dredging permits. (The Corps' power to deny permits other than on navigation grounds is being tested in court by those same Galveston shell dredging interests.)

The Dingell-Kennedy Bill. However, these actions do not satisfy such concerned defenders of estuaries, as Congressmen Dingell and Tenzer, and Senator Edward Kennedy. They have authored legislation that would underwrite needed research into estuary ecology. The legislation would give

Interior equal status with the Corps in granting dredging permits. (This policy would be extended to the Great Lakes area, where Corps dredging projects jeopardize the Nation's best preserved urban waterfront, the Chicago lakefront.) The legislation would also foster a National Estuarine Area system in cooperation with local and State agencies. Concern has been expressed that this latter provision would grant too much power to the Federal Government. In testifying in support of this provision, Executive Director Thomas L. Kimball of the National Wildlife Federation said, "We feel that requirement that each recommendation for designation as a 'National Estuarine Area' be approved by Congress is ample protection against any possible arbitrary moves to bring these areas into Federal control."

The testimony of one witness before Congressman Dingell's subcommittee helps underline the timeliness of such comprehensive measures. Clyde Slease, spokesman for the National Sand and Gravel Association, said his industry needs access to 42 billion tons of sand and gravel in the next 30 years. This is a lot of sand and gravel, but the Association has already pinpointed a likely source: "Estuaries near such metropolitan centers as New York City, Baltimore, Washington, Norfolk, Richmond, Mobile, New Orleans and Philadelphia offer a principal source of sand and gravel for the construction industry in these cities," testified Mr. Slease. Mr. Slease argued against the Dingell-Kennedy legislation as opposing "an inoffensive use such as sand and gravel dredging". While some interests would reduce estuaries to bottomless quarries, other interests would fill them up to create real estate. To expedite this process, a California State legislator advocates setting back the boundaries of an estuary from the traditional mean high water mark to the mean low water mark. This would effectively legislate the intertidal right out of existence. It anticipates the bulkheading of our coastline.

The challenge of estuarine conservation is great, both on a scientific and political level. But so are the stakes: the birthright of our favorite marine life. If we do deny the sea its cradles, we will be denying our children a means to survival. John Clark, in "Fish and Man", observed "With the world now rapidly approaching a time of widespread food shortage, we surely cannot afford to carelessly destroy these rich areas that are so highly productive of protein foods."

And the sea is not alone in its need of estuaries.

APPENDIX F

REENGROSSED HOUSE BILL NO. 946
(Chapter 139)

State of Washington
40th Extraordinary Session

By Representatives Anderson, Bledsoe, Day, Holman, Smythe, Marsh, O'Dell, Zimmerman, Brazier, Lewis and Chatalas

Read first time March 13, 1967, and referred to Committee on Revenue and Taxation.

AN ACT Relating to air and water pollution control; providing certain tax credits and exemptions for air and water pollution control facilities; providing certain damages for injury to or for destruction or reduction in quality of the state's natural resources; defining crimes and prescribing penalties; and adding new sections to chapter 216, Laws of 1945 and to chapter 90.48 RCW; authorizing the levying of money penalties by the water pollution control commission; and providing for recovery of moneys for damages to resources of the state.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF WASHINGTON:

NEW SECTION. Section 1. Unless a different meaning is plainly required by the context, the following words as hereinafter used in this act shall have the following meanings:

(1) "Facility" shall mean an "air pollution control facility" or a "water pollution control facility" as herein defined: (a) "Air pollution control facility" includes any treatment works, control devices and disposal systems, machinery, equipment, structures, property or any part or accessories thereof, installed or acquired for the primary purpose of reducing, controlling or disposing of industrial waste which if released to the outdoor atmosphere could cause air pollution. "Air pollution control facility" shall not mean any motor vehicle air pollution control devices used to control the emission of air contaminants from any motor vehicle. (b) "Water pollution control facility" includes any treatment works, control device or disposal system, machinery, equipment, structures, property, or any accessories thereof installed or acquired for the primary purpose of reducing, controlling, or disposing of sewage and industrial waste which if released to a water course could cause water pollution:

PROVIDED, That the word "facility" shall not be construed to include any control device, machinery, equipment, structure, disposal system or other property installed or constructed for a municipal corporation or for the primary purpose of connecting any commercial establishment with the waste collecting facilities of public or privately owned utilities.

(2) "Industrial waste" shall mean any liquid, gaseous, radioactive or solid waste substance or combinations thereof resulting from any process of industry, manufacture, trade or business, or from the development or recovery of any natural resources.

(3) "Treatment works" or "control device" shall mean any machinery, equipment, structure or property which is installed, constructed, or acquired for the primary purpose of controlling air or water pollution and shall include, but shall not be limited to such devices as precipitators, scrubbers, towers, filters, baghouses, incinerators, evaporators, reservoirs, aerators used for the purpose of treating, stabilizing, incinerating, holding, removing or isolating sewage and industrial wastes.

(4) "Disposal system" shall mean any system containing treatment works or control devises and includes but is not limited to pipelines, outfalls, conduits, pumping stations, force mains, solids handling equipment, instrumentation, and monitoring equipment, ducts, fans, vents, hoods, and conveyors and all other construction devices, appurtenances and facilities used for collecting or conducting, sewage and industrial waste to a point of disposal, treatment or isolation except that which is necessary to manufacture of products.

(5) "Certificate" shall mean a pollution control tax exemption and credit certificate for which application has been made not later than December 31, 1969: PROVIDED, That with respect solely to a facility required to be installed in an industrial, manufacturing, waste disposal, utility, or other commercial establishment which is in operation or under construction as of the effective date of this act, such application will be deemed timely made if made within one year after the effective date of specific requirements for such facility promulgated by the appropriate control agency.

(6) "Appropriate control agency" shall mean the state water pollution control commission; or the operating local or regional air pollution control agency within whose jurisdiction a facility is or will be located, or the state air pollution control board, where the facilis not or will not be located within the area of an operating local or regional air pollution control agency, or where the state air pollution control board has assumed jurisdiction.

(7) "Commission" shall mean the state tax commission.

NEW SECTION. Section 2. An application for a certificate shall be filed with the commission in such manner and in such form as may be prescribed by the commission. The application shall contain estimated or actual costs, plans and specifications of the facility including all materials incorporated or to be incorporated therein and a list describing and showing the cost, of all equipment acquired or to be acquired by the applicant for the purpose of pollution control, together with the operating procedure for the facility, or a time schedule for the acquistion and installation or attachment of the facility and the proposed operating procedure for such facility.

NEW SECTION. Section 3. A certificate shall be issued by the commission within thirty days after approval of the application by the appropriate control agency. Such approval shall be given when it is determined that the facility is designed and is operated or is intended to be operated primarily for the control, capture and removal of pollutants from the air or for the control and reduction of water pollution and that the facility is suitable, reasonably adequate, and meets the intent and purposes of chapter 70.94 RCW or chapter 90.48 RCW, as the case may be, and it shall notify the commission of its findings within thirty days of the date on which the application was submitted to it for approval. In making such determination, the appropriate control agency shall afford to the applicant an opportunity for a hearing: PROVIDED, That if the local or regional air pollution control agency fails to act or if the applicant feels aggrieved by the action of the local or regional air pollution control agency, such applicant may appeal to the state air pollution control board pursuant to rules and regulations established by that board.

NEW SECTION. Section 4. The commission may adopt such rules and regulations as it deems necessary for the administration of this act subject to the provisions of RCW 34.04.020 through 34.04.060. Such rules and regulations shall not abridge the authority of the appropriate control agency as provided in this act or any other law.

NEW SECTION. Section 5. (1) The original acquisition of a facility by the holder of a certificate shall be exempt from sales tax imposed by chapter 82.08 RCW and use tax imposed by chapter 82.12 RCW when the due date for payment of such taxes is subsequent to the effective date of the certificate: PROVIDED, That the exemption of this section shall not apply to servicing, maintenance, repairs, and replacements of parts after a facility is complete and placed in operation.

(2) Subsequent to the effective date of this act the holder of the certificate may, in lieu of accepting the tax exemption provided for in this section, elect to take a tax credit in the total amount of the exemption for the facility covered by such certificate against any future taxes to be paid pursuant to

chapters 82.04, 82.12, and 82.16 RCW: PROVIDED, That on and after the effective date of this act is such person elects to take a tax credit for a facility under this subsection he may not take further credit under RCW 82.04.435.

NEW SECTION. Section 6. (1) On and after the effective date of this act, an application for a determination of the cost of an existing or newly completed pollution control facility may be filed with the commission in such manner and in such form as may be prescribed by the commission. The application shall contain the final cost figures for the installation of the facility and reasonable supporting documents and other proof as required by the state tax commission. In the event such facility is not already covered by a certificate issued for the purpose of authorizing the tax exemption or credit provided for in this act, the commission shall seek the approval of the facility from the appropriate control agency. The commission shall determine the final cost of the pollution control facility and issue a supplement to the existing certificate or an original certificate stating the cost of the pollution control facility: PROVIDED, That the cost of an existing pollution control facility shall be the depreciated value thereof at the time of application filed pursuant to this section.

(2) When the operation of a facility has commenced and a certificate pertaining thereto has been issued, a credit may be claimed against taxes imposed pursuant to chapters 82.04, 82.12, and 82.16 RCW. The amount of such credit shall be two percent of the cost of a facility covered by the certificate for each year the certificate remains in force. Such credits shall be cumulative and shall be subject only to the following limitations:

(a) No credit exceeding fifty percent of the taxes payable under chapters 82.04, 82.12, and 82.16 RCW shall be allowed in any reporting period.

(b) The net commercial value of any materials captured or recovered through use of a facility shall, first, reduce the credit allowable in the current reporting period and thereafter be applied to reduce any credit balance allowed and not yet utilized: PROVIDED, That for the purposes of this act the determination of "net commercial value" shall not include a deduction for the cost or depreciation of the facility.

(c) The total cumulative amount of such credits allowed for any facility covered by a certificate shall not exceed fifty percent of the cost of such facility.

(d) The total cumulative amount of credits against state taxes authorized by this act shall be reduced by the total amount of any federal investment credit or other federal tax credit actually received by the certificate holder applicable to the facility. This reduction shall be made as an offset against the credit claimed in the first reporting period following the allowance of such investment credit, and thereafter as an offset against any credit balance as it shall become available to the certificate holder.

(3) Applicants and certificate holders shall provide the commission with information showing the net commercial value of materials captured or recovered by a facility and shall make all pertinent books and records available for examination by the commission for the purposes of determining the credit provided by this act.

NEW SECTION. Section 7. Nothing in this act shall be deemed to affect the application of credits pursuant to RCW 82.04.435 accumulated prior to the effective date of this act.

NEW SECTION. Section 8. If subsequent to the issuance of a certificate or supplement for a facility, a determination is made to modify or replace such facility, the holder thereof may file an application for a new certificate or supplement covering such modified or replacement facility in accordance with the procedures set forth in this act for original certificates and supplements thereto. After the issuance by the commission of any new certificate or supplement, all subsequent tax exemptions and credits for the modified or replacement facility shall be based thereon.

NEW SECTION. Section 9. The commission shall send a certificate or supplement when issued. by certified mail to the applicant. Notice of the commission's refusal to issue a certificate or supplement shall likewise be sent to the applicant by certified mail.

NEW SECTION. Section 10. The water pollution control commission or the state air pollution control board, after notice to the commission and the applicant and after affording the applicant an opportunity for a hearing, shall, on its own initiative or on complaint of the local or regional air pollution control agency in which an air pollution control facility is located, or is expected to be located, revise the prior findings of the appropriate control agency whenever any of the following appears:

(1) The certificate or supplement thereto was obtained by fraud or misrepresentation, or the holder of the certificate has failed substantially without good cause to proceed with the construction, reconstruction, installation or acquisition of a facility or without good cause has failed substantially to operate the facility for the purpose specified by the appropriate control agency in which case the commission shall modify or revoke the certificate. If the certificate and/or supplement are revoked, all applicable taxes from which an exemption has been secured under this act or against which the credit provided for by this act has been claimed shall be immediately due and payable with the maximum interes and penalties prescribed by applicable law. No statute of limitations shall operate in the event of fraud or misrepresentation.

(2) The facility covered by the certificate or supplement thereto is no longer operated primarily for the purpose of the control or reduction of water pollution or the control, capture, and removal of pollutants from the air, as the case may be, or is no longer suitable or reasonably adequate to meet the intent and purposes of chapter 70.94 RCW or chapter 90.48 RCW, in which case the certificate shall be modified or revoked.

(3) Upon the date of mailing by certified mail to the certificate holder of notice of the action of the commission modifying or revoking a certificate or supplement, the certificate or supplement shall cease to be in force or shall remain in force only as modified.

NEW SECTION. Section 11. Any aggrieved person may appeal to the superior court in the county in which the facility is located. Such appeal from the commission, the water pollution control commission or the state air pollution control board shall be governed by the terms of Chapter 34.04 RCW.

NEW SECTION. Section 12. If any phrase, clause, subsection or section of this act shall be declared unconstitutional or invalid by any court of competent jurisdiction, it shall be conclusively presumed that the legislature would have enacted this act without the phrase, clause, subsection or section so held unconstitutional or invalid and the remainder of the act shall not be affected as a result of said part being held unconstitutional or invalid.

NEW SECTION. Section 13. There is added to chapter 216, Laws of 1945 and to chapter 90.48 RCW a new section to read as follows:

Any person who violates any of the provisions of this chapter, or fails to perform any duty imposed by this chapter, or violates an order or other determination of the commission or the director made pursuant to the provisions of this chapter, including the conditions of a waste discharge permit issued pursuant to RCW 90.48.160, and in the course thereof causes the death of, or injury to, fish, animals, vegetation or other resources of the state, or otherwise causes a reduction in the quality of the state's waters below the standards set by the commission, thereby damaging the same, shall be liable to pay the state damages in an anount equal to the sum of money necessary to restock such waters, replenish such resources, and otherwise restore the stream, lake or other water source to its condition prior to the injury, as such condition is determined by the commission. Such damages shall be recoverable in an action brought by the attorney general on behalf of the people of the state of Washington in the superior court of the county in which such damages occurred: PROVIDED, That if damages occurred in more than one county the attorney general may bring action in any of the counties where the damages occurred. Any money so recovered by the attorney general shall be transferred to either the state game fund for the department of fisheries to use for food fish or shellfish management purposes and propagation, or to any other agency of the state having jurisdiction over the resource damaged and for which said moneys were recovered, as appropriate: PROVIDED, That the agency receiving such money shall utilize not less than one-half of said money on activities or projects within the county where the action was brought by the attorney general. No action shall be authorized under this section against any person operating in compliance with the conditions of a waste discharge permit issued pursuant to RCW 90.48.160.

NEW SECTION. Section 14. There is added to chapter 216, Laws of 1945 and to chapter 90.48 RCW a new section to read as follows:

Every person who:

(1) Violates the terms or conditions of a waste discharge permit issued pursuant to RCW 90.48.160, or

(2) Conducts a commercial or industrial operation without a waste discharge permit as required by RCW 90.48.160, or

(3) Violates the provisions of RCW 90.48.080, shall incur, in addition to any other penalty as provided by law, a penalty in the amount of one hundred dollars a day for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be and be deemed to be a separate and distinct violation. Every act of commission or omission which procures, aids or abets in the violation shall be considered a violation under the provisions of this section and subject to the penalty herein provided for. The penalty herein provided for shall become due and payable when the person incurring the same receives a notice in writing from the director of the commission describing such violation with reasonable particularity and advising such person that the penalty is due. The director may, upon written application therefor, received within fifteen days, and when deemed in the best interest to carry out the purposes of this chapter, remit or mitigate any penalty provided for in this section or discontinue any prosecution to recover the same upon such terms as he in his discretion shall deem proper, and shall have authority to ascertain the facts upon all such applications in such manner and under such regulations as he may deem proper. If the amount of such penalty is not paid to the commission within fifteen days after receipt of notice imposing the same, or application for remission or mitigation has not been made within fifteen days after the violator has received notice of the disposition of such application, the attorney general, upon the request of the director, shall bring an action in the name of the state of Washington in the superior court of Thurston county or of any other county in which such violator may do business, to recover such penalty. In all such actions the procedure and rules of evidence shall be the same as an ordinary civil action except as otherwise in this chapter provided. All penalties recovered under this section shall be paid into the state treasury and credited to the general fund.

APPENDIX G

Name	Address
Speakers	
Eric O. Anderson	State Representative, 627 Grand Ave., Hoquiam, Wash. 98550.
Bob Bailey	State Senator, Representing Cong. Julia Butler Hansen, South Bend, Wash. 98586.
J.J. Stein	P.U.D. #1, of Grays Harbor, P.O. Box 480, Aberdeen, Washington. 98520.
L.M. McGinnis	ITT Rayonier, P.O. Box 299, Hoquiam, Washington. 98550.
Carmelita Shackleford (Mrs.)	LANCE Representative, Star Rt. #1, Box 355, Belfair, Washington. 98528.
James Connolly	Mason County Planning Director, P.O. Box 488, Shelton, Washington. 98528.
J.O. Julson	Weyerhaeuser Company, Tacoma Bldg., Tacoma, Washington. 98401.
Lewis R. Holcomb	Wash. Public Ports Ass'n., 210 E. Union, P.O. Box 1518, Olympia, Washington. 98501.
James Guenther (Mrs.)	League of Women Voters, 1603 W. 10th, Olympia, Washington. 98501.
Clarke M. Williams	ITT Rayonier, N.W. Central Eng. Div., P.O. Box 539, Hoquiam, Washington. 98550.

Name	Address
Attendees	
Russell Akiyama	Grays Harbor-Pac. Health Dist., County Court House, South Bend, Wash. 98586.
R. V. Anderson	City Engineer, City Hall, Aberdeen, Washington. 98340.
Carlton E. Appelo	Wahkiakum Port #2, Deep River, Washington. 98618.
Jack Ayerst	Wash. Dept. of Game, 600 No. Capitol Way, Olympia, Washington. 98501.
Richard M. Beebe	Wash. St. Dept. of Commerce & Economic Dev., Gen. Admin. Bldg., Olypia, Wash. 98501.
James Behlke	Wash. Water Pollution Control Comm., P.O. Box 831 Olympia, Washington. 97205.
Lawrence S. Braund	Rayonier, Inc., Central Engineering, Hoquiam, Washington. 98550.
Roy Brown	Weyerhaeuser Co., Cosmopolis, Wash. 98537.
Jack A. Cameron (Mrs.)	League of Women Voters, 3022 So. Lorne, Olympia, Washington. 98501.
E. W. Clocksin	Port of Grays Harbor, P.O. Box 660, Aberdeen, Washington. 98520.
Lloyd Allen Cook (Mrs.)	LANCE Representative, P.O. Box 69, Union, Washington. 98592.
Arthur K. Crews	Wash. State Dept. of Game, P.O. Box 102, Aberdeen, Wash. 98520.
Joseph B. De LaCruz	Business Mgr., Quinault Tribe, Box 1112, Taholah, Washington. 98587.
Gene Deschamps	Wash. Dept. of Fisheries, 401 West Wishkah St., Aberdeen, Washington. 98520.
G. C. Digerness	Wash. St. Soil & Water Conserv. Comm., 355 General Admin. Bldg., Olympia, Wash. 98501.
Michael D. Ells	Grays Harbor-Pac. Health Dist., 223 Finch Bldg., Aberdeen, Washington. 98520.
Donald R. Fisher	Weyerhaeuser Co., Cosmopolis, Wash. 98537.
T. J. Glenn	Port of Bellingham, P.O. Box 728, Bellingham, Washington. 98225.

Name	Address
Attendees	
Sydney W. Glover	Planning Dir., Grays Harbor Regional Plan. Comm., 207½ E. Market St. 98501.
George H. Hansen	Water Pollution Control Comm., P.O. Box 829, Olympia, Washington. 98501.
Jim Hanson	ITT Rayonier, Hoquiam, Washington. 98550.
Donald R. Hopkins	State of Wash., Dept. of Natural Resources, Box 168, Olympia, Washington. 98501.
B. W. Houtz	Soil Conservation Service, E. 103 Broadway, Montesano, Washington. 98653.
Tim Joyner	BCF, 2725 Montlake Blvd.E., Seattle, Wash. 98102.
Robert J. Kain	Mgr., P.U.D. #2 of Pacific Co., P.O. Box 472, Raymond, Wash. 99206.
Lloyd P. Kirry	St. Plan & Comty. Affairs Agy., 1306 Capitol Way, Olympia, Wash. 98501.
R.M Knight	Weyerhaeuser Co., Cosmopolis, Wash. 98537.
Stanley K. Knox	Water Pollution Control Comm., P.O.Box 829, Olympia, Washington. 98501.
E.H. Lemier	Wash. Dept. of Fisheries, Rm. 115, Gen. Admin. Bldg., Olympia, Washington. 98501.
Dave Luman	Bur. of Land Management, 729 N.E. Oregon St., Portland, Oregon. 97208.
B.E. Mauderscheid	U.S. Bureau of Reclamation, P.O. Box 5200, Spokane, Washington. 99202.
Milt Martin	Wash. St. Parks & Rec. Comm., 522 So. Franklin St., Olympia, Wash. 98501.
K. H. Mosoaugh	F.W.P.C.A., 570 Pittock Block, Portland, Oregon. 97205.
Richard Murakami	Coast Oyster Co., South Bend, Wash. 99204.
Carl T. Nelson (Mrs.)	League of Women Voters, 1120 N. Broadway, Aberdeen, Wash. 98520.
Vern R. Nelson	USDA-Soil Conservation Service, P.O.Box 647, Olympia, Washington. 98501.

Name	Address
Attendees	
J. Robert Oliver	Grays Harbor Paper Co., P.O. Box 60, Hoquiam, Washington. 98550.
Dick Petersen	ITT Rayonier, Inc., Hoquiam, Wash. 98550.
Duane E. Phinney	Wash. Dept. of Fisheries, 401 W. Wishkah, Aberdeen, Washington. 98520.
Leighton H. Powell	Grays Harbor County, 625 Prospect, Hoquiam, Washington. 98550.
Donald E. Proctor	Wash. State University, Pullman, Washington. 99163.
Robert A. Salmon	Aberdeen Water Dept., City Hall, Aberdeen, Washington. 98520.
Otto H. Sangder	Rayonier, Inc. Grays Harbor, Box 299, Hoquiam, Washington. 98550.
Warren E. Shanks	Bur. Sports Fish & Wildlife, Div. of Fisheries Services, 730 N. E. Pacific, Portland, Oregon. 97232.
J. A. Tannahill	Grays Harbor P.U.D., 717 Bluff, Hoquiam, Wash. 98550.
H. J. Van DeRiet	Coop. Extension Service, 12 Federal Bldg., Shelton, Washington. 98584.
Frank J. Vrabeck	Army Corps of Engr., 1519 Alaskan Way, So., Seattle, Washington. 98104.
John E. Ward	P.U.D. #1 of Snohomish Cty & R. W. Beck & Assoc., 200 Tower Bldg., Seattle, Wash. 98101.
Robert Watson	Dept. of Game, 527 Emerson Ave., Hoquiam, Washington. 98550.
Thomas C. Williams	Thurston County Soil & Water Cons. Dist., Courthouse Annex, Olympia, Wash. 98501.
James C. Willmann	F.W.P.C.A., 570 Pittock Block, Portland, Oregon. 97205.
Scott Witt	Weyerhaeuser Co., Cosmopolis, Wash. 98537.

INDEX

INDEX

Anderson, Eric O. 139

Baily, Bob 145

Bartlett, Francis G. 27, 114

Behlke, James P. 8, 25, 41, 66, 138, 155, 163, 178, 189 200, 206

Bishop, Wayne 42

Bower, Bob O. 44

Clare, Herbert C. 3, 67, 74, 133, 143, 167, 200

Cole, Bert 222

Columbia River Fisherman's Protective Union 221

Connolly, James 164

Durning, Marvin 16

Fulton, Harry R. 69

Glenn, Tom 191, 194

Grays Harbor Chamber of Commerce 228

Grays Harbor Soil & Water Conservation District . . . 227

Guenther, James (Mrs.). . . . 197

Holcomb, Lewis R. 182

Hougen, Conrad 75

Julson, J. O. 169

Katz, Max 51

Kirry, Lloyd 154, 176, 186, 204

LeMeir, Emanuel 210

INDEX (Continued)

Lower Columbia River Sportsmen's Council 230

McGinnis, L. M. 148

Mountford, Kent 93

O'Connell, John J. 9

Pelly, Thomas 87

Port of Seattle 97

Sargent, C. S. 79

Shakelford, Carmelita (Mrs.) . 31, 104

Skagit County Park and Recreation Board 111

State of Washington Soil & Water Conservation Comm. . . 234

Stein, J. J. 146

Thurston Co. Soil & Water Conservation District . . . 237

Vlastelicia, John 30, 49, 156, 166, 177, 187, 215

Ward, John E. 62

Washington State Assoc. of County Park Bds. & Depts. . 110

Washington State Dept. of Fisheries 224

Wastler, T. A. 61, 67, 144, 163, 166, 174, 208, 214

Western Washington State College 91

Whatcom County Soil & Water Conservation District . . . 113

INDEX (Continued)

Williams, Clarke M. 212

Yoshioka, Arthur H. 35

Zickefoose 23